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Cables Laid in Bitumen.

YEARS ago, the laying of cables "solid in bitumen" attained so wide a popularity that in many districts it was standard practice, and was looked upon as a very satisfactory method of dealing with low-pressure distribution mains. Certainly bitumen has the advantage that it is imperishable, and, when the work is efficiently done, waterproof, though much trouble was experienced in early days due to the use of wooden bridges to support the cables. Such bridges sooner or later became damp, and electrolysis resulted where lead-sheathed cables rested on them, with disastrous consequences. With suitable stoneware bridges this risk was removed. Coal gas reacts on bitumen, causing it to soften, but apparently this has not proved a serious disadvantage: more serious drawbacks are its liability to crack under concussion, admitting water, and to be decomposed at high temperatures, so that a fault on the mains producing an arc may generate large quantities of gas which unfortunately is highly inflammable and, if mixed with air, violently explosive.

As the result of such an explosion, which took place at Acton last June, the Electricity Commissioners appointed Mr. G. Scott Ram, M.I.E.E., H.M. chief electrical inspector of factories, and Dr. J. S. Haldane, F.R.S., to investigate the circumstances; their report is quoted in an official memorandum which appears in our "Notes" columns to-day, together with the Commissioners' recommendations to authorised undertakers based upon the report.

The Acton case, of course, is but one of many; quite recently there have been two explosions of this nature in Manchester, as well as a case where four persons were asphyxiated by gas which, as in the Acton instance, entered a house by way of underground channels. On December 29th two explosions took place close to the Royal Institution, London, which suffered some damage,

and whilst the evidence is not conclusive as to the cause, suspicion was cast on the electric mains. It is fortunate that explosions of this nature generally occur under the pavement, and rarely result in personal injury.

As long ago as the year 1913 the subject had attracted public attention, and a bad accident at Hebburn led to the appointment of a committee by the Board of Trade to go into the whole question; the report of that Committee was abstracted in our issue of July 10th, 1914, and commented on at considerable length. Engineers who are directly interested in the subject would probably find it to their advantage to consult those records. It is interesting to note that on that occasion the point now emphasised by the Electricity Commissioners was explicitly stated: "No unstopped pipe should ever be allowed to enter a building." Had that maxim been efficiently observed, many lives would have been spared; the use of clay plugs was shown by the Acton case to be inadequate to prevent the passage of gas. An effective alternative, then pointed out, was to use armoured service cables.

It is noteworthy that at the date of that report, no explosions had been experienced with cables carrying alternating current; this may have been due to the great preponderance of d.c. systems in those days, but it has a bearing on the question of electrolysis. Moreover, some undertakings using the bitumen system on a very large scale had been free from trouble. There is no doubt that skilled workmanship is a most important factor in the matter, and that if great care is taken in jointing, bonding, and laying the cables, the bitumen solid system is capable of giving excellent results over long periods of years, provided that it is free from serious disturbance. Nevertheless we believe that it is rarely, if ever, employed nowadays.

The I.E.E. North-Western Centre.

THE annual dinner of the North-Western Centre of the I.E.E. last week went with a swing which makes it a pleasant memory. Mr. J. R. Clynes struck a congenial note when he urged that public authorities should get the best men and *pay* for them, and the tone of his subsequent remarks made it clear that he was on the side of the angels of peace and goodwill in industry; if those concerned did nŏt learn wisdom from past experience (of industrial conflict) nothing could teach them! Mr. A. Page was equally optimistic; whilst he carefully avoided promising a "cheap" supply of electricity, he was confident as to its abundance. Naturally the Barton power station, the most efficient in this country, came in for a word of commendation. Manchester is not only the most important general engineering and industrial centre of the kingdom, but also the headquarters of the electrical engineering industries, and the chairman of the Centre, Mr. A. B. Mallinson, in proposing the toast of "Our Guests," made it clear that in his view the strength of the Institution itself lay not in London but in the local Centres.

Holborn Automatic Exchange.

SINCE the first public telephone exchange in London operated on the automatic system was put into service there have been many and loud complaints about the delays experienced by subscribers in "getting through." That minor difficulties would be met with under the circumstances was inevitable, and we have not attached much weight to the adverse comments of the lay public, anticipating that, as at Leeds, Sheffield, and other places where the automatic system has been successfully adopted, the users would soon learn to perform the dialling efficiently and the operating staff would also settle down to the new methods. But when an electrical engineer of the eminence of Mr. H. Marryat comes to the end of his patience, and produces traffic diagrams showing that he is receiving only a partial service as compared with that of the previous year (see page 158), we are compelled to treat the matter seriously.

Mr. Marryat contends that his business is suffering material damage owing to the inability of his clients to ring him up, and that his outgoing calls are similarly curtailed, in spite of the expansion of his business. We may point out that, so long as part of London is telephoned on the manual and part on the automatic system, it will be necessary to maintain in operation "tandem exchanges," such as that described in our issue of October 7th, 1927, for the purpose of translating dialled calls into vocal calls, and *vice versa;* this intermediary inevitably involves a slight delay in obtaining connection, in addition to the normal period, which is already longer on the average than in other populous centres, owing to the fact that the majority of London calls pass through two or more exchanges. Moreover, the dialling operation, involving seven manipulations, requires some practice to enable it to be performed quickly and accurately. These sources of delay will eventually disappear as the automatic system displaces the manual and the users acquire facility in operation, and we have no doubt that the result will be a greatly improved service, in accordance with experience at provincial centres.

In the meantime, however, Mr. Marryat's business—and presumably that of many other subscribers, both inside and outside the Holborn area—is suffering, and it is poor consolation to say that all will be well some day. We shall be interested in learning what the Post Office proposes to do to mitigate the trouble; if an improvement can be effected by increasing the staff of operators, or by employing more highly skilled operators, at the exchanges concerned, no question of expense should be allowed to stand in the way—efficiency is the soul of telephone service, and it is manifestly unjust that one section of the public should be set at a disadvantage during the conversion of the system.

The Faraday Medal.

THE award of the Faraday Medal to Professor J. A. Fleming, F.R.S., D.Sc., Hon. M.I.E.E., by the Council of the Institution of Electrical Engineers will be heartily endorsed by engineers and scientific workers throughout the world. Few men have worked so hard—or so long—in the service of electrical science and of the public, and none is more worthy of the high distinction which his confrères have conferred upon him. As original research worker, as inventor, as historian, and above all, perhaps, as teacher, Dr. Fleming stands in the front rank of British scientific men. His activities extend over half a century, covering the whole range of modern electrical engineering; a pupil of Clerk Maxwell himself, his teaching career commenced in 1881, and for 42 years he occupied the chair of electrical engineering at University College, London, displaying distinguished ability and untiring industry. He is probably best known to the world as the inventor of the first thermionic valve, but his engineering interests have covered a far wider field, and he has been loaded with well-earned honours by the leading scientific bodies.

Electricity Output in Great Britain.

IN *The Times* of January 21st there appeared a report of a statement by Mr. H. Quigley, chief economist of the B.E.A.M.A., to the effect that there had been an increase of 25 per cent. in the output of electricity in Great Britain during 1927—the highest figure since the war, and greater than the German, American, and Canadian figures. The fact that in 1926 the increase was only 3 per cent. was mentioned, but no reference was made to the general strike and the prolonged coal dispute, to which are due both the small increase in 1926 and the (relatively) large increase in 1927. These two years, obviously, ought not to be used for the purpose of comparison, and it is customary in statistical statements to draw attention to this fact, lest improper conclusions be drawn from the returns.

Electricity Supply in London.

In order to meet the requirements of its ten constituent companies and any other authorised undertakers to whom it is empowered by statute to furnish electricity until its franchise terminates in 1971, the London Power Company, Ltd., is actively co-ordinating the generation and transmission at 22 kV of electrical energy within its sphere of influence.

THE London and Home Counties Electricity District, as delimited by the Electricity Commission in 1920,* includes the City of London, City of Westminster, and the other 27 metropolitan boroughs, Middlesex, and parts of the six neighbouring counties. To facilitate the unification of electrical administration therein, the constitution of a Joint Electricity Authority was contemplated under the Electricity (Supply) Acts, 1919 and 1922, which was to be representative of authorised company and municipal undertakers, county councils, large consumers (chiefly the railway companies) and workers in the industry; was to purchase all of the generating stations in the area, ensure that the base load was carried by the most efficient of them, close down uneconomical plant, and provide for the erection of new capital stations as and when needed; both companies and municipalities were to purchase energy wholesale from the J.E.A. and distribute it retail to their consumers.

The three main bodies which submitted schemes and whose views the Electricity Commission desired to harmonise were the London Electricity Joint Committee (1920), Ltd., now known as the London Power Co., Ltd. (representing ten of the metropolitan companies), the Conference of Local Authorities (representative of municipal undertakings), and the London County Council (which had power to purchase all the London Companies' undertakings in 1931, or at any subsequent period of 10 years, subject to three years' notice and to its purchasing all if it purchased any one). Such large Power Companies as the Metropolitan and North Metropolitan, which were constituted under different Acts of Parliament, were not affected.

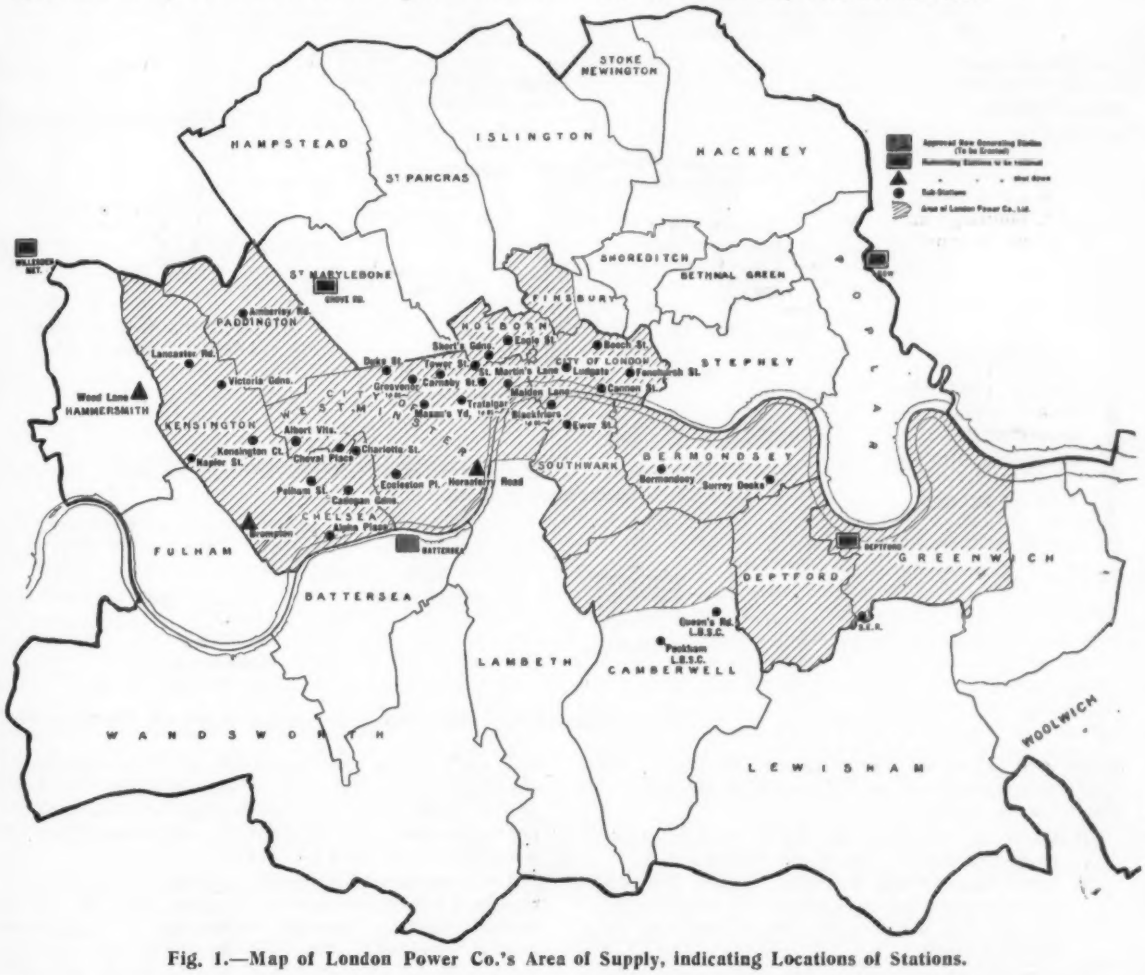


Fig. 1.—Map of London Power Co.'s Area of Supply, indicating Locations of Stations.

The three bodies reached the same conclusion regarding the "technical scheme" formulated by a Joint Engineers Committee, but failed to agree financially and politically.

The complexity of the problem is made evident by the recollection of the number of unification schemes submitted.† One of the most practical suggestions was that of Mr. W. F. Fladgate (chairman of the Charing Cross, West End and City Electric Supply Co., Ltd., and of the London Electricity Joint Committee (1920), Ltd.), who proposed the formation of two Joint Electricity Authorities to represent, respectively, the

* ELEC. REV., July 23rd, 1920.

† See ELEC. REV., Feb. 11th, Mar. 3rd, May 13th and 20th, June 17th, and Dec. 23rd, 1921; June 23rd, 1922; Feb. 16th and Mar. 16th, 1923; April 11th and May 9th, 1924.

company and municipal undertakings in the area, voluntarily co-operating initially, with a view to possible future combination. The Electricity Commission endeavoured to frame a scheme to some extent carrying out this suggestion by means of one Authority with two independent Committees, but that scheme was declared to be *ultra vires* in the Law Courts.

Meanwhile, the London County Council continued negotiations with the Companies, and ultimately the London and Home Counties Joint Electricity Authority* was established in July 29th, 1925, whilst the London Electricity Acts (Nos. 1 and 2), 1925, became law two days later. The No. 1 Act empowered the four Companies named in the first schedule to that Act to amalgamate. The No. 2 Act provided for the transfer of the generating assets of the ten Companies named in the first schedule to it to the London Power Co., Ltd., and the supply of energy by the L.P. Company to the ten Companies. The Act subjected all the 14 Companies to a sliding scale of prices and dividends and extended their tenure to 1971, when their undertakings will be transferred to the J.E.A. on the following terms:—

(*a*) Assets in use when the J.E.A. was constituted to be transferred free of cost to the J.E.A.

(*b*) Assets subsequently provided by the Companies to be transferred on payment of capital expenditure, less depreciation (to be provided by a sinking fund).

The company groups are thus financially and administratively independent, having rights of appeal to the Electricity Commission with respect to (i) technical development (which must be in accordance with the Electricity Commission's agreed engineering scheme; (ii) disposal of surplus energy in excess of the requirements of the Companies concerned; (iii) capital expenditure of the Companies which will ultimately be repayable by the J.E.A. (*i.e.*, expenditure not entirely covered by the sinking fund before 1971); and (iv) maintenance of the assets to be transferred eventually to the J.E.A. Consequent on the large measure of autonomy secured by them, the Companies' representation on the J.E.A. was made very small. The passing of the Electricity (Supply) Act, 1926, materially modified the position outlined above, especially with regard to the scope and nature of the "engineering scheme" which will now be finally determined by the Central Electricity Board.

The London Power Co., of which Mr. W. F. Fladgate is chairman, and Mr. W. A. Pearman general manager, consists of the undermentioned undertakings:

Brompton and Kensington Electricity Supply Co., Ltd.
Charing Cross Electricity Supply Co., Ltd.
Chelsea Electricity Supply Co., Ltd.
London Electric Supply Corporation, Ltd.
Metropolitan Electric Supply Co., Ltd.
Kensington and Knightsbridge Electric Lighting Co., Ltd.
Notting Hill Electric Lighting Co., Ltd.
Saint James' and Pall Mall Electric Light Co., Ltd.
Westminster Electric Supply Corporation, Ltd.
Central Electric Supply Co., Ltd.

They have all of them transferred their stations and main transmission lines to the L. P. Company in order that the latter may co-ordinate supplies and exercise full control over the generation and transmission of electricity within the areas of the ten constituent Companies, whilst the latter retain their full and complete rights as authorised distributors; this transaction was completed on January 1st, 1928.

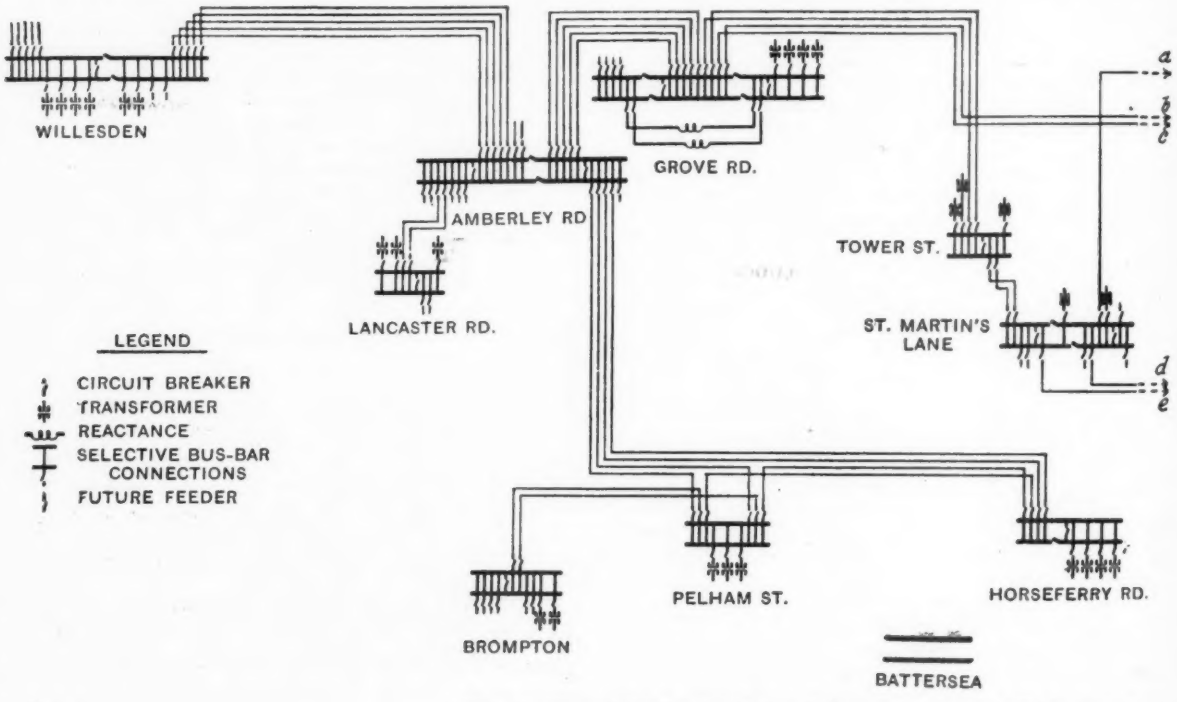


Fig. 2.—Plan of the London Power Company's 22,000-volt Underground—

The constituent Companies receiving energy from the standard a.c. interconnected 3-phase, 50-cycle, system divide monthly amongst themselves the aggregate annual "pooled" costs on the basis of a two-part tariff, the division of which into standing and running charges is determined by means of a "P" curve, the load factor of which is that of the interconnected portion of the system based on the maximum demand on the L. P. Company; it will not necessarily be coincident with the simultaneous m.d. of any individual constituent Company, and is deemed to be made at 22,000 volts, which is tantamount to pooling all losses at that pressure. Should the power factor of the system of any constituent Company fall below 0.8, it becomes liable to such an extra charge as the engineer-in-chief of the L. P. Company may deem appropriate.

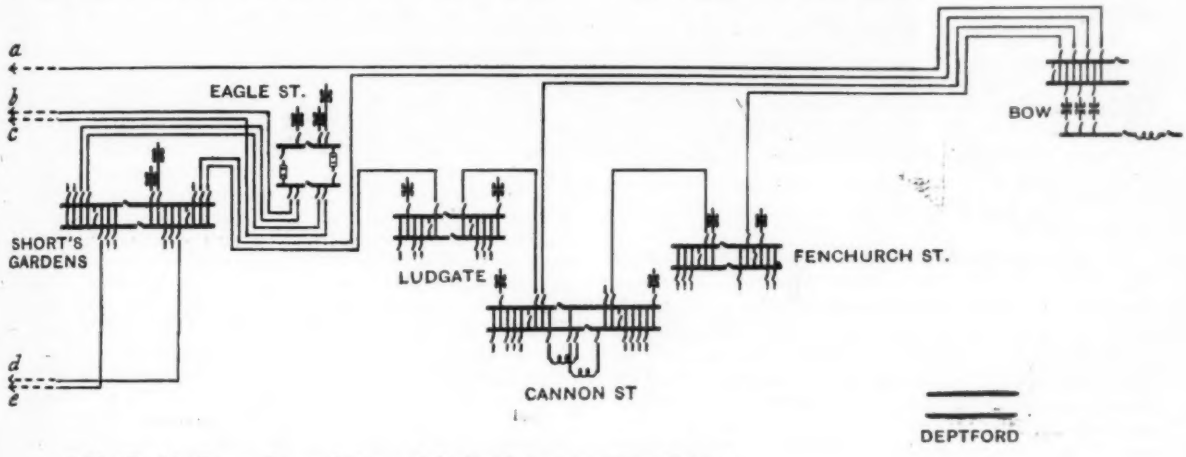
In virtue of its constitution, the L.P. Company is precluded from distributing any profit to its members or shareholders and also from paying interest on its capital beyond a fixed rate, while the dividends of the constituent distributing Companies are restricted

* See ELEC. REV., Nov. 13th, 1925.

by the terms of the London Electricity (No. 2) Act, 1925, until 1931; from that date the standard dividend is to be 7 per cent. on their ordinary share capital, the provision having been made that only one-seventh of any surplus earned on a fixed standard price may be appropriated for the shareholders, whilst six-sevenths must be devoted to the reduction of consumers' charges.

There are clear indications that unified control will enable the existing generating plant, and that in course of erection, of the L.P. Company to carry a load over twice as great as its combined load in 1922, with ample reserve. The sites of the existing and future generating stations and distribution centres of the L. P. Company are indicated on the accompanying map (fig. 1), and the annual demand it will have to satisfy, including railway supplies up to a figure greatly in excess of the 45,000 kW which is already being furnished, is shown in Table I.

It must, however, be borne in mind that those estimates were made with respect to the normal growth



—Cable Electric Power Transmission and Station-Int erconnection System.

only of the ten constituent Companies' own distribution areas, and do not allow for energy supplied by the L. P. Company directly or indirectly to "outside" authorised undertakers, or other bodies, apart from supplies of energy afforded by the L. P. Company to enable the constituent Companies to meet contracts entered into by some of them with the Council of the Metropolitan Borough of St. Marylebone, the Southern Railway Co., and the "outside" areas of the Metropolitan Co. to the extent of that Company's demands. Excluding the demand on the Deptford (East) station's (i) 85-cycle, single-phase and (ii) 25-cycle, single- and 3-phase systems (mainly, but not exclusively, for traction), the 3-phase, 50-cycle demand on the L. P. Company's system is estimated to be as shown in Table II.

TABLE I.—ESTIMATED TOTAL DEMAND.

Year ending Dec. 31st.	Maximum Load, kW.	Load Factor %.	Energy to feeders, kWh millions.
1926 actual	201,572	24.0	420
1927 actual	226,811	25.5	506.39
1928 estimated	256,400	27.4	615
1930 ,,	326,000	29.4	840
1932 ,,	410,000	31.5	1,159

TABLE II.—ESTIMATED 3-PHASE DEMAND.

Year ending Dec. 31st.	Maximum Load, kW.	Load Factor %.	Energy to feeders, kWh millions.
1928 ...	196,400	24.5	422
1930 ..	260,000	26.7	607
1932 ...	340,000	29.0	863

The first four undermentioned generating stations have been, or are being, extended by some 200,000 kW of plant, to be completed by the winter of 1929-30:—

(*a*) *Bow* (Charing Cross Co.)*: One 18,750-kW, 3-phase, 50-cycle turbo-generator set with complementary boilers, &c., together with a new step-up transformer station, making its total capacity 71,000 kW.

(*b*) *Grove Road* (Central Co.): One 18,750-kW, 50-cycle, 3-phase turbo-generator set, with boilers, cooling towers, &c., making its total capacity 110,000 kW.

(*c*) *Willesden* (Metropolitan Co.): One 18,750-kW and two 25,000-kW, 3-phase, 50-cycle turbo-generators, with boilers, cooling towers, &c., and a new 22,000-volt switch house and step-up transformer house, making its total capacity 103,750 kW.

(*d*) *Deptford (East)*† (London E.S. Corporation, Ltd.): One 25,000-kW, 25-cycle turbo-generator for railway load, making its total capacity 149,000 kW.

(*e*) *Deptford (West)* (London Power Co.): Work on the site of this new capital station, adjacent to the Deptford (East) plant on the River Thames, commenced last spring. Contracts have been placed for two 25,000-kW and two 35,000-kW turbo-generator sets, and frequency changers are to be installed ultimately for the purpose of tying together the 50-cycle and 25-cycle plant in the West and East stations respectively; the (West) station, the first section of which is expected to be available for commercial service early in 1929, will have an ultimate capacity of about 150,000 kW.

(*f*) *Battersea* (London Power Co.): The Electricity Commission finally approved of this new capital station in November, 1927. The 15-acre site has a frontage of 800 ft. on the Surrey bank of the River Thames immediately below the Victoria Bridge of the Southern Railway Co. It will become one of the "selected" stations for the Central Electricity Board's South-East England scheme‡, and is intended to be partly in operation by the winter of 1931-32. The size of the turbo-generating sets to be initially installed will be 60,000-kW, and it is contemplated that the station will ultimately contain nearly 400,000 kW of plant.

Stations (*a*), (*b*) and (*c*) are intended to function as peak-load, part-time, or seasonal generating centres, whilst (*d*), (*e*) and (*f*) will carry the base load of the system. The L. P. Company's total installed plant capacity at all stations is at present 406,250 kW, which figure will be increased to 678,750 kW by the winter of 1932.

Consequent upon the above-mentioned plant extensions, the L. P. Company has been able to close the Horseferry Road station (Westminster Co.), and also intends to close down as and when circumstances permit the stations at Richmond Road (Brompton and Kensington Co.), Wood Lane (Kensington and Knightsbridge and Notting Hill Joint Committee), and Alpha Place (Chelsea Co.).

During the past year the L.P. Company has been

* For description of reconstruction, see ELEC. REV., May 22nd, 1925.

† For description of remodelled station, see ELEC. REV., June 3rd, 1927.

‡ ELEC. REV., Oct. 7th, 1927.

actively engaged upon the laying of an extensive 22,000-volt transmission system of underground cables for the purpose of interconnecting the several generating stations and distributing centres which it controls; fig. 2 is a plan of this high-voltage network. Concurrently with the foregoing work, a series of new switching stations has been established at the following distribution centres:—

Eastern Section: Fenchurch Street, Cannon Street, Seacoal Lane, Ludgate, St. Martin's Lane, and Shorts Gardens.

Western Section: Horseferry Road, Tower Street, Eagle Street, Amberley Road, Lancaster Road, and Brompton.

It will be appreciated that the organisation and staffing of the London Power Company has involved much work being carried out during the past 12 months, while a new suite of headquarters offices has been occupied in Horseferry Road, Westminster, which serve as the "control centre" of the Company. Mr. S. L. Pearce, C.B.E., D.Sc., M.Inst.C.E., M.I.Mech.E., M.I.E.E., F.Amer.I.E.E., is engineer-in-chief, and to him we are indebted for facilitating the preparation of this article.

A New Lighting Installation.

The scheme of illumination adopted at the Weston-super-Mare Winter Garden Pavilion embodies some unusual and interesting features.

THERE has recently been completed at Weston-super-Mare an interesting lighting installation at the Winter Gardens Pavilion of the Urban District Council, a magnificent building which is intended to be used alternatively as a concert hall and dance pavilion.

The building is constructed about an elliptical central hall which is covered by a domed roof, fig. 1, measuring 90 ft. × 60 ft., and is surrounded by a promenade 15 ft. wide with a vaulted roof. Natural lighting is obtained through windows in the outside walls of the promenade and by a central lantern at the top of the dome.

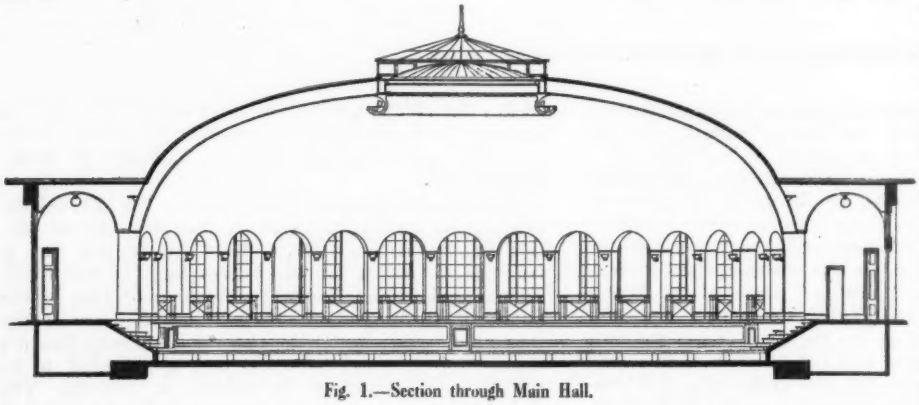


Fig. 1.—Section through Main Hall.

In considering possible schemes of artificial lighting it was felt that any form of pendant fitting in the dome would mar the very fine architectural lines of the interior, and that the necessary apparatus should be as inconspicuous as possible.

The scheme adopted is one by a local firm of electrical engineers, Messrs. Crowe & Green, and is designed to emphasize the architectural features of the building. The lighting in the main hall is entirely indirect, the units being carried in copper-bronze bowls mounted on wood brackets on the columns supporting the dome. Fig. 2 is a view of the interior of the Pavilion showing the inverted-bowl bracket fittings. Each bowl contains a 300-watt gas-filled lamp in a specially designed concentrating reflector focused on to the highest part of the dome, so that the maximum illumination is at that point, the intensity being gradually reduced on the lower parts of the dome and walls. So well have the units been disposed, it is claimed, that it is impossible when standing on the floor to detect the source of the light.

For dancing, the main lighting is dimmed out and a scheme of colour lighting provided by means of which the interior of the dome is bathed in a glow of ever-changing colour. The lamps for this scheme are mounted in special trough reflectors concealed within the cornice around the base of the central lantern, fig. 1. Three colours are used, the lamps being closely spaced in two rows with the colours arranged alternately. The lamps for each colour are wired on separate circuits, each controlled by a specially graded motor-driven dimmer; the three dimmers are so interlocked that the colours are mingled in pairs. The intensity of illumination remains constant while the colour varies by imperceptible graduations through a pre-arranged cycle.

In order that the change-over from white to colour lighting may be effected in a pleasing manner it is arranged to be done automatically, with push-button control placed within reach of the bandmaster. On depressing the "colour" button the colour lighting is switched on, but it is at first not apparent. The white light is then gradually dimmed down and finally blacked out, leaving the colour only in operation. The switching-in of the colour lights automatically starts the motor of the colour-change dimmer, which normally remains in operation so long as the colour lighting is in use. Should it be desired, however, to maintain one shade of colour indefinitely for a particular effect, the motor can be operated independently by hand control to bring up the desired colour before switching on, and then cut out, so that the dimmer remains stationary.

The lighting of the promenade is by amber lamps in opal-globe fittings in the crown of the vault. These also are dimmed down, but not extinguished, during the periods of colour lighting in order that the latter may be seen to full advantage.

A test taken after the building had been in use some four months and the lamps and reflectors had become dulled with dust, gave an average light intensity at the dance floor of between 5 and 6 foot-candles for the white lighting.

The main switchboard is housed in a small room alongside the main hall, and above this a similar room accommodates the dimmers and automatic gear. The resistances of the colour dimmers are of wire wound

on porcelain-enamelled steel tubes and the sliding contacts are driven through reduction gearing by a shunt-wound electric motor. In grading the resistances the object was to secure a constant lighting intensity throughout the colour-change cycle, and this involved a good deal of experimental work. Although curves are published giving the relation between lumens, watts and volts for clear lamps, none could be obtained relating to colour-sprayed ones, and, indeed, the lumen

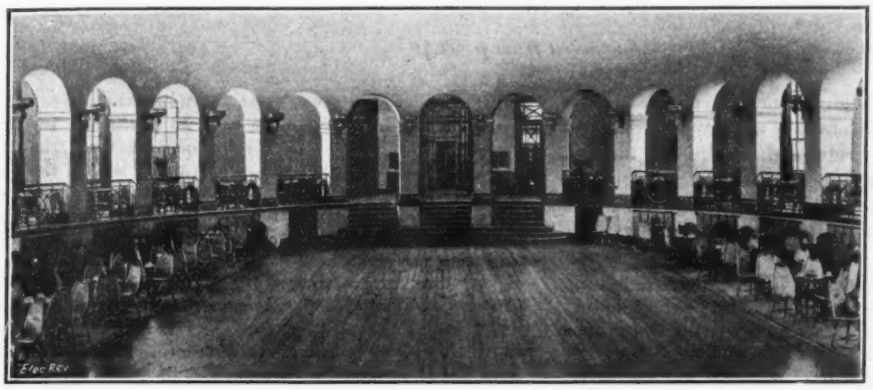


Fig. 2.—Interior of Pavilion.

has no precise meaning for such lamps. The resistance grading was therefore determined by setting up a length of trough reflector fitted with coloured lamps, the intensity of the illumination being judged by one or two people sitting in fixed positions and reading small print. In this way curves of the lamp voltage against time were plotted for each of the three changes, blue to red, red to orange, and orange to blue. It was found that for each orange lamp two red were required and three blue. There are two rows of trough reflector, one above the other, the upper being designed for 75-W lamps and the lower for 60-W ones. There are 93 blue, 62 red and 31 orange lamps in each trough.

It was found that when the lamp voltage was reduced to 150 the light emitted was negligible, and in order to avoid the surge which would result in the mains by the instantaneous switching off or on of a bank of lamps taking some 12½ kW, the lamps are dimmed down during the dark periods to this pressure and not blacked out.

The dimming operations with the direct-contact tubular type of resistance involve the reversal of the direction of motion of the contact sliders, with periods of rest at each end of their travel.

The reversing gears are controlled by friction clutches operated by means of cams on an auxiliary shaft which is geared down so as to make one revolution for each complete cycle of the colour change.

Fig. 3 depicts diagrammatically the layout of the control circuits, the switches, safety devices, and so on, being omitted for the sake of clearness. The ¼-h.p. motor for operating the colour dimmer is tapped off directly from the colour circuit, so that it starts as soon as the circuit is energised. The two white circuits each have double-pole dimmers A and B mounted on a common base and driven by the motor C. At each end of this combined dimmer are three small one-way switches, normally held closed by springs and arranged to be opened by the slider of the dimmer just as it reaches the end of its travel. The switches P, Q, R, S, T and U, together with three two-way switches X, Y and Z at the push-button control station energise the operating coils of the contactors and the armature of the motor C. The control-station switches are mechanically coupled and arranged to be thrown over by two push buttons.

The wiring throughout is lead-sheathed cable, manufactured by Messrs. Callender's Cable & Construction Co., Ltd., and the greater part of it is run on boards specially provided between the inner and outer structures of the building around the base of the dome. In other places it is run through lengths of light-gauge steel conduit buried in the plaster work.

The joint architects are Messrs. Mawson & Sons, and Mr. H. A. Brown, C.E., Surveyor and Engineer to the Weston-super-Mare Urban District Council.

The novel features of the installation are protected by patents taken out by Messrs. Crowe and Green, who, as already indicated, designed and carried out the complete installation.

Weighing by Radio Methods.

One of the latest applications of the radio principle is a weighing machine developed by the laboratory staff of a large New England producer of pulp and paper. This unique device automatically weighs any material, such as paper, rubber, chewing gum, and coated fabrics, passing through the mechanism in continuous web form; the weighing is accomplished at full speed without touching the web of the material at any point, says the A.I.E.E. *Journal*.

The principles underlying this unusual development are those of the tuned radio circuit: the web of material

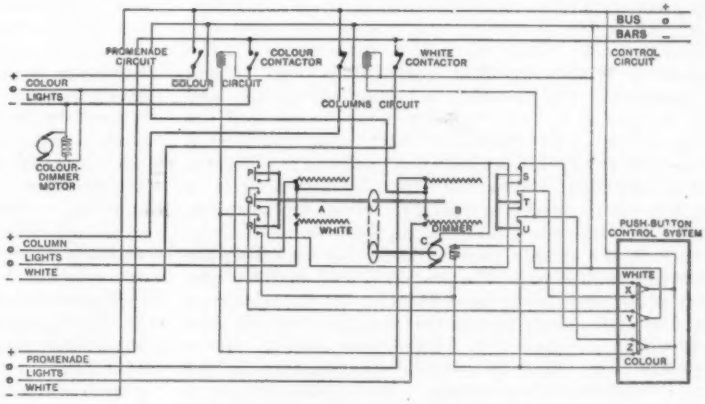


Fig. 3.—Lighting Control Circuits.

passes between two parallel metal plates which act as a condenser in the receiving circuit. Variations in the weight of the web change the capacity of the condenser and affect the response of the circuit to a wave of controlled frequency; the variations are shown on a meter in the circuit and may be used to operate the machine controls by suitable relays. The machine is of great service in maintaining uniformity in the weighing of paper, and an adaptation of the device may be used to register the moisture content of the paper.

It is obvious that methods of measurement of this description are capable of application to an almost unlimited range of industrial processes.

Shoddy Wiring.

The author refers to the harm done to the electrical industry by bad installation work, discusses how the jerry wireman and shoddy work may be suppressed, and scathingly exposes the weaknesses of the National Register of Electrical Installation Contractors.

By H. R. TAUNTON.

(*Continued from p.* 92.)

THE N.R.E.I.C., though not necessarily the best, is the first and most obvious weapon wherewith to attack the shoddy wireman. That was the end for which it was founded; indeed, the possibility that in some other and better form it may yet help to secure that end is the only justification for its present rather feeble existence.

Certainly it cannot help us as it is to-day. The high hopes with which it was launched have unfortunately not been realised. So much its most ardent champions have to concede. They have to admit that its long list of names is neither sufficiently inclusive nor exclusive. There are firms of standing—members even of its parent, the E.C.A.—who for one reason or another refuse to be registered. There are others, of the very class against which it was designed, who have contrived to creep into its fold. Few, perhaps; but however few, enough to be a menace to the whole. The architect who yesterday would have looked askance at plain Jerry & Co., finds them to-day on the list of the N.R.E.I.C., and entrusts them with a job. They make of it a shoddy job; and the disillusioned architect not unnaturally blames the Register for persuading him to employ a firm he would otherwise have ignored. A few such black sheep, and the one thing that makes the Register of value to the community—faith in it as a guarantee of competence—is shattered.

It is to be feared that the Register has, to some extent, already lost caste with those to whom it would appeal. It has lost, too, some of the sympathy of the contractors themselves. The anticipation, the goodwill with which they greeted its birth is in danger of turning to indifference. The child is—what?—five years old? and still unable to walk; truth to tell, a little rickety. The impression is growing that registration and annual re-registration are becoming a matter of routine, and that the powers by which offenders can be expelled are being atrophied by disuse—in short, that membership of the N.R.E.I.C. is too easily got, and too easily kept.

Easy criticism. What is difficult—assuming it is justified—is to suggest a remedy. How, for instance, are we to raise the qualifications for admission so as to exclude the shoddy man without also excluding the deserving small man? The present list of qualifications —(*a*) equipment, (*b*) present practice, (*c*) experience or training—adequately covers the ground. No addition to it would improve it. Rather the reverse. It is arguable that the only essential qualification is the third: experience or training. The possession of a vague "equipment," the fact that the applicant is actually practising in trade, does not ensure that he will practise it worthily. These two conditions, and the further condition which the Committee may at its discretion call for—commercial standing—represent the very natural desire of established firms with heavy standing charges to place some check on the competition of the small man, unhandicapped by office expenses; and, without so crudely disclosing their motives, they can argue reasonably enough that the man of straw cannot effectively guarantee his handiwork, however good. On the other hand, the man of straw may be to-morrow the man of substance. There are big men in the trade who were once ambitious wiremen. Why should their followers on the ladder of success be knocked off the first rung by a cast-iron Register, because perforce they start without the advantages which figure in an estimate as "20 per cent., to cover standing charges"? Surely the broader view, the view from the standpoint of the public weal, is that the only thing that matters is "competence"; and if it were made the only qualification for registration we should merely be following the excellent examples of the doctors and the lawyers.

We are digressing, however, into an essay on altruism. We have to remember that the N.R.E.I.C. was founded not only in the interests of the public, but in those of the established contractors; and from the dual point of view the present list of qualifications can hardly be bettered. In practice, its effectiveness in excluding undesirables depends very largely on the local committees, on whom headquarters necessarily rely; and since these committees must vary largely in their character, we have here an obvious loophole in the working of the scheme.

Some years ago, the Committee in a certain town was asked to report on the application for registration of a small local firm. Of the three members, one was the manager of the local tramways: he could hardly be expected to know much of the applicant. Another was the Corporation engineer who, as it happened, knew no more. Both, therefore, were obliged to ask their third colleague who, as an E.C.A. contractor, was able to tell them more; so that in practice, the registration of his competitor depended on his verdict.

That may be an extreme instance, but it serves to illustrate the importance of strong local committees in the administration of the scheme. On them must necessarily depend the status of the Register; more particularly, when we come to consider the question of expulsion from it. Critics complain that the Executive's powers in that respect are exercised neither rigorously nor frequently enough. Others grumble that to expel a member from the N.R.E.I.C. "cuts no ice"—which is tantamount to denying the value of registration. That, however, is a poor reason for inaction. We have to look ahead to the day when expulsion will mean as much to an offending contractor as being "struck off the roll" now means to a defaulting solicitor.

Those critics who would enforce to the utmost the penalties provided are in the right of it; but in their impatience they do not always envisage the difficulties of taking action. Committees cannot act until complaint is made to them; and if they do not often act, we may fairly assume they rarely receive complaints. That is the gist of the matter: there is nobody whose business it is to arraign the shoddy contractors.

We cannot count on the layman to do it. He is often an unsuspecting victim; and even if he knows he has been swindled, the chances are he has never heard of the N.R.E.I.C. Moreover, that body would be rightly chary of acting on a complaint from a layman which might prove to be no more than a display of ignorance or ill-temper.

Nor can we count on the supply companies to initiate inquiries into shoddy work. We might reasonably expect it from them, considering that their nominees sit on the Registration Board; but actually we have to appreciate that it would hardly be consistent of them to connect up, as they will light-heartedly, a

faulty job, and then report the contractor concerned to the N.R.E.I.C.

The only others to whom we can look are individual members of the N.R.E.I.C. and the E.C.A.; and they can only take effective action when they happen to be called in to rectify bad work. Confronted with the law of libel and the difficulty of obtaining compelling evidence, it is little wonder that few can be found to take the first step in what is at best an invidious procedure against a fellow tradesman.

A third common complaint against the Executive is the little headway apparently made in securing the real co-operation of the other members of the electrical industry, and of the consultants, architects, and builders. But the N.R.E.I.C. can hardly be blamed for that. They do what they can, though it is little more than to circulate periodical lists of members, which are probably tossed to one side and forgotten. Those who should be blamed are those who nominate members of the Registration Board and do nothing more to help it. Of the hundreds of specifications issued every week by consultants, how many stipulate that the tenderer shall be a member of the N.R.E.I.C.? And yet, since the Association of Consulting Engineers has officially approved the scheme, that is surely the least its individual members could do.

That we have a Register at all is something; it is at least a jumping-off point—for which we owe thanks to the E.C.A. There must be some way of using it effectively; of removing its weaknesses and anomalies; of making it, in fine, a lusty weapon in the fight against shoddiness.

Consider, for instance, the complaint that the Register does not include all the good firms who are members of the E.C.A. That is surely easily met. Why should not membership of the E.C.A. automatically cover membership of the N.R.E.I.C.? Some of the E.C.A. firms who at present refuse to join it might still refuse to avail themselves of its advantages; but they would, willy-nilly, be subject to its conditions, and their names, despite them, would add lustre—we hope—to its list.

This step would, of course, mean a shrinkage of the income of the N.R.E.I.C.—but would it not be worth it? And there would be possible financial compensations. To begin with, membership of the N.R.E.I.C. (without membership of the E.C.A.) might, as already hinted, be made easier by limiting the qualification to "competence"; but if that were thought inadvisable, we could still expect the Register to grow in popularity with every improvement in its status, and that might in time compensate for the immediate loss of fees from the E.C.A. members. Moreover, membership of the N.R.E.I.C. would then be in effect a lower grade of membership of the E.C.A. Firms paying the registration fee would presently realise that for a little more they could secure the wider advantages of the parent body. So the E.C.A. would benefit; and it is not unlikely that in course of time it would, like Cronos of old, absorb its offspring. That would solve a lot of difficulties: the present inconsistency, for instance, whereby we have to advertise two hall-marks of good work, and two—sometimes conflicting—qualifications on which we have to advise the public to insist.

If this proposal were adopted, it would practically mean that there would be two classes of registered contractors. The E.C.A. class—being presumably, in the matter of shoddy wiring, so many Cæsar's wives—would have the privilege of remaining on the Register as long as they were members of the E.C.A. Those in the N.R.E.I.C. class, on the other hand, would be subject to scrutiny at each annual renewal of certificates. The scrutineers would be a strong local committee, whose members would thus have an opportunity of dealing collectively with rumours against an applicant which they might have heard in the course of their business, but on which, as individuals, they would hesitate to base a definite accusation. It would not be a question, then, of initiating action against a suspect, but simply of judging him on facts known to all. That would greatly facilitate the weeding-out of undesirables. It is hardly likely that any would survive a couple of such scrutinies. Shoddy work cannot be long hidden under a bushel—certainly not from trade competitors.

As to the third contention—that the N.R.E.I.C. have failed to secure the co-operation of the other bodies interested (theoretically) in the abolition of shoddy work, and notably of the consultants and architects—the only answer to that is, that it must first convince them of the value of the Register as a guarantee of good work. The mere strengthening of the Register would go a long way towards that. What would go further would be the setting-up of a definite standard of wiring work to which all members would be required to subscribe. It is true there could be no machinery for enforcing it by inspections; but a definite pledge is a sub-conscious guide to rectitude, the more so if those who might be tempted to break it knew they risked expulsion.

Would it not, then, be possible for the N.R.E.I.C. to adopt a compulsory code of wiring rules, which would, of course, consist of those clauses of the I.E.E. code applicable to contracting; abridged and simplified, it may be, on the lines of the E.C.A. handbook recently reviewed in these columns?

Further, would it not be possible for them to stipulate that all members should pay their men not less than the recognised local rates? That, perhaps, may not be a popular suggestion. It may be objected that it would be playing into the hands of the E.T.U. But the E.C.A.—or more correctly the N.F.E.A.—have already adopted such a clause themselves. Why should it not be extended to the N.R.E.I.C.? The modern contractor is surely above the old-fashioned jealousy of the trade unionist—even were this not a matter in which the interests of both march together.

Finally, is it possible to fix some standard for the more commonly used wiring materials? Good workmen working to good rules with bad materials may yet produce a shoddy job. It is true, a contractor forced to employ expensive labour is the less likely to waste it on cheap-and-nasty material. On the other hand, the man we want to fetter, the jerry wireman, may sin from ignorance, or from sheer, short-sighted perversity. The I.E.E. rules might assist us in certain cases, and the B.E.S.A. standards—if it be practicable to make them compulsory—in others; but for the rest, it is difficult to make any suggestion—such as the list of approved cable makers attached to Post Office specifications—which would not unduly restrain competitive trade.

Whatever may be thought of these suggestions, one thing is certain: that without some definite standard by which it can be measured, shoddy wiring will never be stamped out. At present we have the paradox of a Register which ostensibly exists to maintain a standard which doesn't exist—inasmuch as it has no standard which it can enforce. If, unaided, it can devise some such standard, that will be a notable achievement which will almost automatically solve our main problem. If it cannot, the question next arises: can it, and should it—it may be left with no option in the matter—look to the Government for assistance?

(To be concluded.)

Great Britain's Radio Exports.

The monthly statement published by the *Wireless Trader* shows that our exports of radio apparatus during November last were valued at £119,124, of which valves accounted for £15,652. The principal customer was Japan, which took goods to the value of £20,421 (valves £3,282); Australia followed with £15,952 (valves £3,257). Other important customers were India, £11,268 (valves £1,972); the Netherlands, £11,088 (valves £148); the Irish Free State, £5,285 (valves £997); Spain, £5,164 (valves £878); and New Zealand, £4,520 (valves £446).

Cable v. Radio.

A Problem of International Importance. Difficulties of a Satisfactory Solution.

By ROLAND BELFORT.

WHEN the history of the present century comes to be written, it will probably be recognised that radio must be regarded as the dominant scientific achievement of the period, just as during the nineteenth century cable enterprise was hailed as an epochal development, marking a new era in the world's progress.

The Radio Revolution.

Electrical science, ever on the march, has already achieved remarkable progress in the universalisation of the world's communications. But the day Marconi consummated his first practical success he introduced into telegraphy a revolutionary development which has affected the whole world's daily life, social and professional, for it has created records in speed and economy; established several new industries; given a powerful impetus to musical and literary development; and increased the amenities of domestic life. Moreover, radio has provided lucrative work for an army of experts of all grades, on land and on the sea.

As may be imagined, electrical science brings into play all the energising forces of modern enterprise—financial courage, scientific genius, diplomatic talent, administrative ability and industrial experience. So many arduous problems have to be solved; vital improvements discovered; numerous and frequent sudden dangers have to be averted or minimised. Yet, throughout, these have been dealt with as they arose, and are to-day still being met by men whose ripe experience and sound judgment enable them to face every emergency. To-day, we can wireless all over the world; shortly we may be able to *speak* over any long distances by the same agency; in the not-too-distant future we may hope to *see* distant objects through wireless. What Marconi has done for shipping needs no emphasis.

The Power of the "Beam."

Moreover, radio has suddenly changed the status, prospects and revenue-earning of the world's submarine cable enterprises, forcing them to face a world-wide rate-reducing combination which has already affected the market value of their shares and may ultimately bring about some startling surprises in their very constitutions. Here I may ask: How many people realise that *wireless itself once hung on a thread?* Marconi, disappointed with his early efforts, had decided to abandon science and enter the Italian Navy. But in 1888 Hertz discovered his famous "waves" and Marconi, studying his works, conceived the possibility of applying those waves to telegraphy—eliminating wires. The birth of radio!

Marconi as Cable "Feeder."

For many years Marconi's enterprise did not appear to disturb the minds of the cable magnates, who asserted that wireless had not diverted from their lines any considerable traffic. I think it was Sir John Wolfe Barry, then chairman of the Eastern Group, who, in 1913, expressed the opinion that Marconi would prove a capital "feeder" for the cables. By a curious coincidence I had a month or two before that suggested that co-operation with Marconi would ultimately prove a sound policy for the cable companies. This suggestion was repeated in 1923 and, at the end of that year, Sir John Pender appeared to confirm this possibility in some guarded observations addressed to his shareholders. There was one critical period when the Eastern Group could have secured a wireless system of its own, perfected by two of England's foremost scientists. For reasons which appear to have been conclusive this opportunity was not embraced. Then came another. There was a moment when Marconi shares fell so low that control could have been secured on "bargain terms." That "deal" I suggested. Even then the Eastern reserves presented a most imposing financial façade. The cable magnates were not impressed. But what an insurance fund those Marconi shares would have constituted for all time!

Advent of the "Beam."

The sudden development of the beam system, which practically revolutionised the position of the cables, brought the cable magnates to reconsider their position. The lead in this movement was naturally taken by Sir John Pender, who approached the Government and subsequently agreed to negotiate with the Marconi Company in order to discover some method of co-operation. The crisis was, perhaps, precipitated by the announcement made by the Prime Minister of Australia, Mr. Bruce, that 45 per cent. of the usual Australian traffic had been diverted from the cables by the beam.

A Triangular Combination.

In electrical circles the difficulties of the position are fully realised. Not the Imperial Government only, but also the Dominions, have important interests in both cables and wireless, both of which are subject, to a certain extent, to the control of the International Telegraphic Convention. It appears doubtful whether any agreement between Marconi's and the cable companies can, therefore, be established without consultation with, and the sanction of, the Imperial Government, itself bound to consult the Dominions. Nor can the various foreign Governments which adhere to the International Telegraphic Convention be disregarded in such a world-development. Dominating this consideration, is the even more important question:—"Who is to *control* Empire radio and cable communications?" On the solution of that basic problem must depend the future of both Marconi and Eastern. To-day, the trend in telegraphy is towards the extension of Imperial Government control within the Empire, and this kindles a red light for private enterprise. Both companies appear to have seen it; the Dominions regard this problem as primordial. What is the position? In a recent interview, Mr. F. C. Kellaway, chairman of Marconi's, made this significant remark:—

"It is unfortunate that the cable companies have found it necessary to appeal to the Government, as *assistance* must necessarily involve some form of *control*."

The cable companies' perception of the red light has been indicated by Sir Geoffrey Clarke, chairman of the Telegraph Construction and Maintenance Co., Ltd. He recently said that the question of unified control was the most difficult and savoured of monopoly. The one thing to be avoided was any form of Government control in such a scheme. That would be disastrous to British communications and would probably be resented by the Dominions.

Such apprehensions appear justified. When the Dominion Cable Conference in Whitehall was organised to discuss the Cable-Marconi rivalry, it was anticipated that the chief difficulties would be associated with the question whether the services were to be run by private enterprise.

The Imperial Government's negotiations in cable and wireless affairs are, to my mind, rather more subtle than certain very eminent people have quite realised. I could quote some striking examples. "The public interest" is a potent slogan for any Minister, and it is just possible that a great surprise may await both sides when their negotiations reach the critical stage.

For, after all, the Imperial Government, now acting as arbitrator and competitor too, has already commenced an "Empiradio" service which must necessarily clash with the interests of private companies. Can they formulate a scheme that will assure the sanction of a puissant State already competing against them? Mr. Kellaway's shrewd maxim "Assistance must connote control" might have come from the present Postmaster-General, instead of from a former one, for it is a condensation of traditional officialism.

Americans as Competitors.

Even should cables and wireless establish a practical working agreement, they will still have to deal with American competition. Recently, we have heard a great deal about "All America Cables," a strong combination of wireless, telegraph, cable and telephone, now controlled by Colonel Behn, as President of the International Telegraph and Telephone Company. Its policy appears to be to link up the United States, South America, the West Indies, South Africa, Egypt, and the principal Mediterranean cities as far as Gibraltar. With their cables across the Pacific, the Americans have their eyes on India, as a field for their cable-wireless operations. They already control the Atlantic cable system, and command the services of British experts, highly-trained managers, electricians and operators, who have no equal in any foreign countries. The Americans are apparently convinced that the scope is immense: dazzling the prize of this control of world communications, which offer opportunities for constant development. What did Mr. Newcomb Carlton, President of the Western Union Telegraph, say in 1923?—

"The radio has made substantial progress during the year, not only in improved service, but in *capturing additional business with low rates from the cable companies.* . . . It has been our view that the resources of radio will be combined with those of the cable in the development of *a system of world communication that will place the United States first among all countries for capacity and reasonable rates.*"

The Machinery of Co-operation.

While the companies concerned appear to agree upon the broad principle that cut-throat competition would cripple both parties, without yielding any decisive results, the fact remains that the discovery of a workable basis of co-operation must prove a difficult, complicated undertaking. So varied and antagonistic are the interests involved. From the cable side comes this suggestion:—

(1) The fixation of equal rates for all telegrams between particular places, with fair competition between wireless and cables.

(2) A joint purse system, by which all traffic receipts on certain routes should be pooled and an agreed portion taken by all parties.

(3) Unified control.

But has Sir Geoffrey Clarke, the author of this proposal, taken into account the fact that the two companies are not the only factors in a complicated problem? In the old days the Imperial Government did not usually interfere actively in inter-cable negotiations or amalgamations. Such affairs were generally settled as between group and group, or company and company. To-day, the State often acts as intermediary and is now in the position of a competitor, whose sanction appears indispensable for any agreement.

Competitors' Relative Advantages.

Eastern strength may be summarised as follows:—(1) Vast organisation, almost world-wide; strong board; staff of trained experts, 8,000 strong. (2) Reserves of £14,000,000; brilliant dividend record. (3) Transmission continuous, night and day throughout the entire system; accuracy and secrecy guaranteed. (4) Valuable agreements with foreign countries and companies, some exclusive for long periods; an army of clients, accustomed to and satisfied with Eastern service. (5) Its system still regarded as indispensable, for State and strategic reasons, in peace as in war. (6) Possibility of reducing rates as a result of economies and higher speed secured already by "loaded" cables and other improvements paid for out of reserves; prospect of introducing further improvements likely to compensate, in a measure, for the advantages accruing to Marconi from the beam system. (7) Finally, the asset of the Pender tradition, long maintained, with its record of financial and administrative success, and admitted services to the Empire, appears likely to count in the present crisis.

Among Marconi's special advantages may be classed the beam, with its rapid and economical service and its potentialities of further development. (2) Slightly lower rates, so far, as compared with those of the Eastern group. (3) Possibilities of fixing still lower tariffs by the multiplex transmission of telegraphic and telephonic messages, using the same stations for both purposes. (4) The splendid—and mainly gratuitous—publicity enjoyed by reason of the romantic and sensational character of Senatore Marconi's enterprise. (5) Direct service, as compared with cables laid in sections, whereby the signals need strengthening at each point of relay. (6) The probability that "fading" may ultimately be eliminated by further research. (7) The relatively cheaper cost of further extensions as traffic increases.

Future of World Telegraphy.

Meanwhile, whatever may be the result of the present negotiations, the science of electrical intercommunication, by land, in the air and under the sea, is destined to further develop. But, whatever marvels radio may in future germinate, it appears doubtful whether the submarine cable will cease to play a prominent part in international communications. There are rumours in cabling circles about developments that may, perhaps, counterbalance the success of the beam; the cable magnates have never ceased to seek further improvements and facilities for their customers, or to render service to the State, wherever possible. Significant sign: other nations are eager to secure their own cable system. America, France, Germany and Italy have been for years striving to emancipate themselves from what they regard as "the throttling monopoly held by the British." They realise that, despite radio, the cable as a means of rapid, secret and accurate communication, with its closed circuit, perfect control and freedom from atmospherics, may be expected to maintain itself on a high level, if not at the monopoly peak formerly enjoyed. Even if they have to divide the traffic of the world with competitors, the stimulation imparted by such intensive competition must tend to cheapen and develop cable traffic in such a ratio that a remunerative revenue may be expected.

Manufacturers' Bright Prospects.

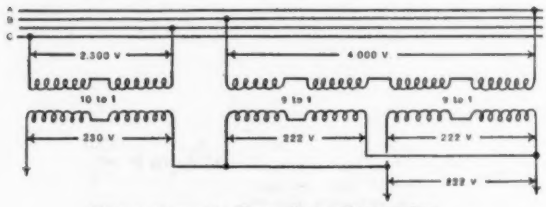
There is another point—vital to electrical interests in this country. The making, laying, repairing and even working of submarine cables is a complicated, specialised industry in which the British still remain pre-eminent. For years to come, foreigners, generally speaking, will still have to look mainly to England for the construction and laying of their cables, much of their material and probably their smartest electricians and operators, if they aspire to attain the indispensable competitive speed that earns dividends. International interests are claiming increased and cheaper telegraphic communications, but experience has proved that private enterprise can do better than any State to satisfy such legitimate demands. During the next decade vast telegraphic projects will be "assembled" and executed; the field for cable and wireless apparatus and accessories will be broadening year by year and sound concerns in a position to meet the demand with first class goods may hope for steady support, now that the new spirit in the industrial world is manifesting itself. Finally, let it be remembered that in the old days only England gave out cable orders, to-day half a dozen countries are extending their cable systems and this must surely stimulate the industry in this country.

A Distribution Scheme.

A method of three- to two-phase conversion, using standard transformers.

By VERNON W. PALEN.

HAVING seen nothing in print in periodicals on the subject, the author desires to "pass along" the method in general use by an electric supply company in the U.S.A. for transforming from three-phase to two-phase. The accompanying illustration is a diagram showing how the three standard transformers are connected. It will be seen that the primary system must necessarily be four-wire star. Since most of the so-called "standard" transformers have 9 to 1 and 10 to 1 ratios, this method of connection has proved most economical in that it does not necessitate special transformers with 87 per cent. tappings, such as are required by the usual Scott connection. It is the experience of the supply company in question that the slight unbalance in the voltages is not objectionable.



Three-phase to Two-phase Conversion.

The 10 to 1 transformer is usually about 1½ times the capacity of the 9 to 1 apparatus; for instance, one combination often used is a 7½-kVA (10 to 1 ratio) with two 5-kVA (9 to 1 ratio) transformers. This, of course, is because the two 9 to 1 transformers carry approximately one-half the load, while the 10 to 1 transformer carries the other half.

Since the two 9 to 1 transformers operate at below normal voltage, the kVA capacity is therefore reduced. In the case cited above the two 9 to 1 transformers are able to carry safely about 8 kVA at the voltage on which they operate, and so, with the 7½-kVA transformer, make up a fairly well-balanced bank.

Dielectric Action.

The study of the subject of dielectrics is not easy, for the many interdependent variables encountered obscure the whole action under a cloud of baffling indefiniteness.

(*Abstract of lecture delivered before the* INSTITUTION OF ENGINEERING INSPECTION.)

AT a recent meeting of the Institution of Engineering Inspection in London, Mr. P. Dunsheath (chief of the Research Department of W. T. Henley's Telegraph Works Co., Ltd.), lectured on the above-named subject, illustrating his remarks with lantern slides and kinematograph films.

In spite of the fact that a very considerable amount of theoretical and experimental work had been carried out, he could not claim that anyone had an exact knowledge of dielectric action. The breakdown strength of a dielectric was not an easily defined characteristic; insulation resistance was spoken of as if it were an absolute characteristic of a given piece of dielectric, but the value obtained was usually entirely dependent on the time at which it was determined, in usual practice, at the end of an arbitrary time interval of one minute. Because of such obscurities, Mr. Dunsheath felt that the study of such tangible effects as were available would be the most useful path towards a complete understanding of the operation of practical dielectrics, because it sometimes led to the detection of errors in generally-accepted ideas. For instance, amongst several effects he demonstrated was one which the lecturer thought might have important applications in transformer and cable operation: a flat lower electrode and a circular upper electrode, separated by about ¼ inch, were submerged in oil; standing on the lower electrode was a drop of water which, on the application of about 5,000 volts between the two electrodes, rose in the form of a point and reached out towards the upper electrode, ultimately bridging the gap and causing breakdown.

Some experiments demonstrating the actions of mixed dielectrics were followed by others showing the lining up of fibres in oil in an electric field: kinematograph films showed in an interesting manner how the fibres set themselves in the direction of the field between two spheres and collected to form a chain from one electrode to another in the most intense part of the field. There seemed, said Mr. Dunsheath, possibilities of the latter experiment aiding insulator design; for the experiment in question use was made of a composite cell having one kind of oil in its interior portion, surrounded by an oil with a different dielectric constant. The fibres were suspended in the (transformer) oil in the outside chamber: and also in the (castor) oil in the inner chamber: when a voltage of about 10,000 V was applied between a pair of metal plates in the composite cell, the refraction of the lining up of the fibres was shown in a remarkably interesting manner. It was suggested that if the outline of the inner cell were made the shape of an insulator section and the electrodes were disposed in the form of conductors supported by the insulator, a study of the fibre movement might help to check the weakness of any particular design.

Another experiment depicted the phenomenon noticed when a needle, or thin rod, dipping into oil was employed as the upper electrode. On the application of voltage, the oil tended to climb up the needle, rising higher and higher as the voltage increased until distinct circulation of the mass of oil commenced at a certain voltage, the direction being up towards the point of the needle. It was shown by means of a film that the rise of the oil was due to the difference in dielectric constants, while the circulation was due to electric "wind" from the needle along the surface.

A series of interesting experiments showed the movement of bubbles of air near to a charged electrode in oil: a needle electrode was suspended over an oil surface in which another electrode was submerged; a sharp crater was formed in the oil on the application of a few thousand volts; increasing the depth of the oil and the voltage increased the size of the crater, and bubbles of air were actually driven into the oil at the point of the crater, while further increase of voltage resulted in violent cratering and circulation of the oil.

Some pretty effects illustrating the effects of mixed dielectrics were obtained by bubbling drops of castor oil through a bath of transformer oil and subjecting the drops to an electric field during the journey. The dielectric constant of castor oil was 4.5 and that of transformer oil 2.1; the castor oil drops were drawn between and clung to charged spheres in the transformer oil, ultimately forming a bridge which broke as soon as the voltage was re-applied; in the case of transformer oil drops in a bath of castor oil, the action was reversed.

In the final series of experiments globules of dry air in a continuous stream were passed up between electrodes at about 30,000 volts; as the globules approached the gap they slowed down, changed shape, and moved out of the plane of the picture. By narrowing the gap and increasing the voltage, the force on the globules at the entrance of the field was made so great that it prevented them entering, and it was amusing to see the way the globules, after arriving at the electrodes, hesitated for a second and decided to avoid the field altogether by rising outside the plates.

Mr. P. Dunsheath was cordially thanked for his lecture in complimentary remarks contributed by Mr. G. L. Addenbrooke, Mr. Ll. B. Atkinson, Mr. P. Rosling, and Mr. R. P. Wilson.

High-pressure Cables.

In an article on this subject published in *La Revue Générale de l'Electricité* for December 24th, 1927, Mr. R. Fric, consulting engineer, reviews the phenomena due to the occlusion of gases in the dielectric of high-pressure cables, and considers the desirability of substituting some other gas for air in the course of manufacture. Experiments on this matter have been undertaken by the Compagnie de Signaux et d'Entreprises Electriques; the results are not yet available, but, after considering the properties of various gases, the author concludes that, whilst every effort should be made to eliminate gas-bubbles from the interior of a cable dielectric, it seems advisable to try to replace air by an inert gas having a dielectric strength and an ionisation potential as high as possible, so as to defer to the utmost the time when the phenomena of gaseous ionisation develop.

The procedure proposed is as follows:—Before actually impregnating the cable, it is raised to the highest temperature short of injuring the paper, in a vacuum; the inert gas is then introduced, at atmospheric pressure or a higher pressure, into the vacuum chamber, for a sufficient length of time to replace the air removed by the evacuation. This cycle may be repeated, after which the vacuum is re-established and the hot impregnating material is allowed to flow in and cover the cable. It appears that preference is given to nitrogen as the substitute for air. The results obtained so far from the experiments are said to have given ground for hoping that the process will increase the reliability of high-pressure cables.

Mining in Malaya.

Some impressions of a visit to the Federated Malay States, with particular reference to the methods of applying electric power in tin mining.

By A. C. SPARKS.

(*Extracts from paper read before the* LONDON BRANCH *of the* ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

ALL the larger towns in the F.M.S. are supplied with electricity by Government or municipal authorities. The population's chief occupation is rubber growing and tin mining: the output of the latter is about 46,000 tons per annum, which is 32 per cent. of the world's estimated output.

Tin Mining.

The methods of winning tin may be classed generally as:—

Dredging.—This method is being extended considerably, the bucket dredge being preferred, and accounts for 25 per cent. of the output. The majority of the dredges are steam driven, with wood or coal fuel, but electric power is now being more largely used, except in special cases of considerable quantities of wood being available on site which, in any case, would require to be cleared before commencing dredging; steam plant is installed for this purpose, it being designed for conversion to electric drive later. The time needed for conversion is at present about four months, which represents material loss of revenue, and needs closer attention. As well as providing space for the electrical plant, the speeds of motors should also be gone into when conversion is contemplated, so that adjustment of gears can be readily made. It appears better to design the dredge for electric drive and apply steam, rather than the other way round, and I suggest that the increased expense of considering the matter in this way would save time on conversion, and the reduction in loss of revenue would more than balance the additional expense.

Electric drive is now much in evidence, but so far each company has had to make its own provision for power supply, which is obtained from steam power houses, oil-electric power houses; and oil-electric dredges (I am not sure that there is an example of this actually in the F.M.S.). The steam power houses burn local coal on normal chain-grate stokers, but keep small standby stocks of Borneo or foreign coal owing to its better storing qualities, as compared with the local coal. The circulating water facilities are generally poor, but the mining companies are able to cool water by connecting together the large ponds usually formed in old workings. The stations are generally in the vicinity of the dredges and transmit at 2,200 or 3,300 volts, 3-phase, 50 cycles, to the dredges by overhead lines carried on wooden poles, which are readily moved to suit the workings. There is frequent and severe lightning in the area, and arresters are used at each end of the lines; that most in favour is the oxide-film type. Two means are employed for getting the power to the dredge: from the overhead line terminal pole near the paddock a cable is run: (1) across the tailings, where it may be partially buried and pass through water, over a pulley above the sluices held on an arm which can move sideways, and down to a drum to which it is connected mechanically and electrically as in the case of lowering pit cables; power is taken from slip rings on the drum; (2) across the paddock on barrel floats and on to a similar drum at the side of the dredge. With method (1) there is only the tension of the cable to watch, but the width of the cutting face may be somewhat restricted; there is a long length of unsupported cable and there may be some interference with the sluice arrangements. With method (2) an additional man is required to look after the floats so as to add or take them out as required, and unless the drum operator is most attentive the dredge may be moved over and the whole tension of the moving winch applied to the cable; even during a short visit I saw this done, though the cable had only been recently repaired on account of a similar occurrence.

The type of cable used is generally v.i.r., the core after insulation being bound together by a series of cambric tapes, then jute served, compounded, and single-wire armoured. Owing to the frequent paying in and out of the cable, the armouring is liable to "bird-cage," and binding wire is put on about every 8 ft. to reduce this tendency. It appears that serving and some form of compounding overall might be a better solution; the type of cable and its operation provide food for thought, and with the considerably extended use of dredges contemplated, there should be quite a market for an economical improvement which is not less reliable.

An up-to-date dredge should work for 22 hours per day, the balance of time being used for inspection and oiling; repairs necessitate a longer shut-down, and floods may hamper work. The annual load factor of a single dredge is approximately 65 per cent., and the daily load factor may reach about 85 per cent. A typical dredge digs 150,000 cubic yards per month, from a depth reaching 60 ft., with buckets 7 cubic feet each, and takes about 260 kW maximum demand, the equipment consisting of:—Transformer, stepping down to 415 volts, 3-phase, 50 cycles; digging motor, 150 b.h.p., driving through a belt, friction clutch and reduction gear, arranged for about 25 per cent. speed reduction continuously and for inching in either direction; 75 b.h.p. (two) classifier pumps; 130 b.h.p. pressure water pumps; 60 b.h.p. ladder hoist; 25 b.h.p. 4-drum winch; 35 b.h.p. screens; 2-25 b.h.p. jigs; 3 b.h.p. short cable drum; 2 b.h.p. bilge pump; 10 b.h.p. auxiliary winch for logs, &c.

There may also be a small pump on land for regulating the tailings water. With the increase in the sizes of dredge contemplated, the power required per dredge may reach 500 to 700 kW maximum demand. Owing to the speed adjustment on all the motors, except pumps and possibly screens, the power factor may be very low, ordinary induction motors being generally used.

The Perak River Hydro-Electric Power Co. is constructing plant for supplying the largest tin mining area, and no doubt power factor will receive greater attention shortly. Reliability is of first importance as heavy losses are sustained in the event of a shut-down, and steps taken to improve the power factor must bear this in mind. An obvious step would be to use synchronous motors for the larger pumps, which has been done in certain cases, but I am not satisfied that this is all that will be required, and some combination of a.c. and d.c. or d.c. alone may develop, a synchronous motor driving a d.c. generator to supply some or all of the variable-speed plant and possibly the whole dredge equipment. At present the whole power on the dredges is transformed down to some 400 volts: if a.c. is favoured, line voltage might be used for the large machines, thus reducing the size of transformer; should d.c. be used in part, only a small transformer for a few of the machines and possibly lighting might be necessary.

Opencast Mining.—This term is rather loose, but covers

(*a*) Gravel pumping: the static head generally is anything up to about 100 ft. The power taken by a 6-in. gravel pump at a static head of 75 ft. is about 60 b.h.p.

(*b*) Hydraulicing: in some cases the pressure is obtained by pumps.

(*c*) Open-cast: gravel pumps and open-cast mines generally use steam or oil engines, and a few suction gas plants. Wood or coal is used for fuel and entails a lot of transport. Some small amount of electric power is used, and the next few years will see large developments in this connection, the plant for supplying the main tin-mining area being now under construction. The motor equipment for gravel pumps is at present designed for close speed regulation within a variation of about 5 per cent., and the power factor is low at times in consequence. I am not clear that further speed reduction will not be called for with the more general use of electric power, and possibly cone pulleys for this purpose might be tried, if not already done. Most of the plant is obtained on the hire or hire-purchase system, the capacity being suitable for the ultimate depth of the mine. Hydraulicing power is sometimes obtained from a suitably controlled natural source, provided the head is sufficiently high to break it and erect a hydro-electric station. The electricity supply thus obtained can be used for various plant about the mine, gravel pumps where water quantity is lacking, or other supplies, and the tail water for nozzle cutters and hydraulic elevators, where the water quantity and lift are suitable. Many factors have to be taken into account to determine the correct point for the installation of the power house; my firm has been associated with two schemes in the F.M.S. in the past, the aggregate generator capacity being 550 kW operating

(*d*) Lode mines, generally in hills: the rock is brought to the surface by inclined haulage, or shafts are sunk and winders installed; that containing tin is crushed and passed through stamps, over James concentration tables, and electro-magnetic separators. This is probably the most expensive form of mining.

Coal Mining.

There are two colliery companies in British Malaya at present—the Enggor Coal Syndicate is very small, while the Malayan Collieries have an output of about 500,000 tons per annum, and practically all the coal is used locally. They do not, however, supply the whole of the coal requirements of the F.M.S. and S.S., probably owing to the high freight rates, as I found oil in use at Penang power houses in the north, and Borneo coal at Singapore in the south, the Borneo coal being supplied from the Malayan Collieries' pits situated there.

They employ the normal colliery plant, and at present the power is largely supplied by portable steam boilers, but there is a power house with an output of about 500 kW for supplying certain plant, and also steam for some of the other surface plant.

General.

Electrical plant is subject to examination by Government inspectors, and has to meet the Government Enactments; all responsible electrical staff is required to pass a qualifying examination, or to have already qualified in some equivalent examination.

Plant and machinery appears to be almost entirely British made, but Chinese are now making gravel pumps. Plant under cover has to be suitable for a shade temperature of about 95 deg. F., and humidity up to nearly 100 per cent.; it should also be well protected against rust, and proof against snakes, small reptiles and insects. Outdoor plant has, in addition, to withstand tropical rains, temperatures up to say 150 deg. F. where exposed to the sun's rays, strong winds at times, severe lightning, and possible interference from monkeys, flying foxes and elephants, the last being probably best dealt with by avoiding their haunts if possible.

Overhead lines may have to be frequently modified to enable the tin-bearing ground supporting them to be mined. Wayleaves have to be sufficiently wide to keep dredges clear of the line, as the height of the dredge is considerably above the economic height of the line, and also to keep tall trees well clear of the line; wood poles have to be protected against white ants. Lines may not be run parallel to telephone lines unless more than 600 ft. away.

Power plant is best insulated with a mica base. Apart from the dredge shore cable, which is a special item, high- and extra-high-voltage cables about buildings or dredges are generally paper insulated, lead covered, single-wire armoured; and outside cables, paper insulated, lead covered, double-tape armoured and served, buried in the ground, are now being tried: medium- and low-voltage cables are rubber insulated. Owing to the difficulty of making cable joints due to the humid climate and heat for jointers, it appears preferable to limit the cable work to pressures up to 11,000 volts between phases, in the present state of the art.

Portable Electric Power Appliances.

AT the informal meeting of the Institution of Electrical Engineers, held on Monday, January 9th, Mr. W. Lang being in the chair, Mr. A. E. Loe opened a discussion on the above-named subject. He said he would only deal very briefly with the heavier appliances and devote more of his time to "Portable Manual Electric Appliances." The old adage that "time is money" was never more truthful than to-day. No channel must therefore be left unexplored to convert man-hour costs into a higher volume of production. To put it another way, they had to avoid paying for sheer force and to pay only for skill in manipulation. It was to this end that the fractional horse-power, universal-wound motor had established itself.

Portable electric drills were now in mass production, in an extremely wide range of capacities, from the miniature sensitive drills for jewellers, instrument makers, dentists, &c., which were fitted with less than a 1/10-h.p. motor, had a maximum drilling capacity up to 1/32 in., and weighed less than 1 lb., up to the shipbuilder's drill equipped with a ½-h.p. motor, which had a drilling capacity of 1¼ in. in steel and wood, and weighed some 70 lb. Far and away the most popular-sized portable drill was that of ½ in. capacity. He estimated the world's total output of electric drills to be now approximately 2,000,000 per annum.

There was a number of portable electric tools in the drill class, such as the valve grinder, which was provided with an oscillating, instead of a rotary, action for grinding-in the valves of internal combustion engines. Then there was the portable electric "tapper," geared down to about 200 r.p.m., which automatically reversed the rotation of the tap when the initial hand pressure was released, or when the machine was pulled towards the operator.

Possibly the tool that had made the most progress next to the drill in the past few years was the portable electric screwdriver, the stud and nut-setter. This tool had been an enormous boon to mass production in the automobile industry. Next was the portable electric grinder, which was invaluable for fettling castings and weldings, and other every-day operations.

The portable electric hand saw would rip and cross-cut or channel hard wood up to a thickness of 3¾ in., at the rate of 5 feet and upwards per minute. The astonishing feature of this tool was the fact that a ¼-h.p. "universal" motor only was employed.

In the woodworking industry they had the portable electric sash planer and the electric mortiser, both remarkable machines in their own specialised classes of work.

The portable electric hammer embodied novel and clever adaptations of old principles. The soul of it was the indispensable motor, the armature shaft of which was extended to accommodate the armature of a low-voltage high-amperage generator, coupled permanently in series with a solenoid coil, surrounding the tool-tappet chamber. The armature shaft terminated with a sprocket, engaging a larger pinion, fitted with a crank pin, and connecting rod, which operated a hollow piston. Inside the piston was an iron core, with a sliding fit. Extending from the base of the iron core was a hardened steel tappet pin, which impinged on the shank end of the drill or channelling tool that was being used.

An "up and down" motion was imparted to the piston, forcing the tappet smartly down on to the tool at the end of each downward stroke. The air pocket formed between the tappet core and the piston head acted as a pneumatic cushion and prevented any mechanical shock from being imparted to the transmission. On the downward stroke, the core was forced by the impulse of the piston through the strong field set up by the solenoid winding. This field, in effect, acted as an electromagnetic spring or cushion, and instantly pulled up the core from the tool head on the upward stroke of the piston. It would therefore be seen that steel springs were dispensed with, and that the pneumatic transmission of the blow avoided any possibility of overloading or damaging the motor or transmission gear.

Portable cloth cutters were of two types—the "round knife" for straight and curved cuts, and the "straight knife" for heavier duty or getting into sharp angle cuts on multiple "lays" of fabric up to 10 in. or 12 in. thick.

Mr. Loe concluded by saying that only about 2 per cent. of the sale of portable electric tools went through the hands of the electrical industry, and that it was mainly done by motor accessories factors, and similar businesses.

Legal.

Fraudulent Prospectuses.

EATON, SOAME & HARLEY SENTENCED.

THE hearing of the charges against Sir Charles Buckworth-Herne-Soame, Bt., Col. E. O. Eaton and R. G. Harley, was resumed on January 18th. The opening of the case at the Central Criminal Court was reported in our last issue. The charges arose out of prospectuses issued by the Chalk Fuel Power Gas and By-Products Corporation, Ltd., it being alleged that they contained statements regarding chalk fuel which were false and misleading.

Sir C. BUCKWORTH-HERNE-SOAME was questioned by the Common Serjeant (Sir Henry Dickens, K.C.), and said that he had never seen the originals of the reports which were mentioned in the prospectuses; he did not often attend the meetings of the company. The letter which he had written, circulated with the prospectuses, did not accurately express his actual acquaintance with the commercial aspect of the fuel. The company had received about £1,500 from the public as subscriptions to shares; he could not say who had had the money. In re-examination by Mr. Valetta he said that he believed in the reports and had no intention of misleading anybody.

ROBERT G. HARLEY then gave evidence, stating that he, Col. Eaton, and the late Mr. Warden were solely responsible for the drawing up of the company's prospectus. He had not seen the originals of the reports, but had no reason to doubt the genuineness of the typewritten copies. The company had received 8,000 requests for samples of the fuel as the result of an advertisement, which led the directors to hope that there would be a similar response when the fuel was placed on the market. The witness was asked for the company's minute book, but the Common Serjeant pointed out that no record of any meeting appeared in it. Harley agreed that the extract from Mr. Mackey's report which was published in the prospectus was not a fair and accurate representation of Mr. Mackey's views.

Col. E. O. EATON, giving evidence, said that he still held the opinion that chalk fuel was a product of national importance. He did not think that the reports in the prospectus were untrue or misleading. All that he had received from the company was £50 for travelling expenses; he had put £500 or £600 of his own money into the concern. Under cross-examination, he admitted that he had been associated with the promotion of about 50 companies, only three of which were paying dividends.

On January 19th, Sir WILLIAM FOSTER said that he had been present at tests of the fuel, and they were regarded as satisfactory by the witnesses. He held shares in the Suddine Co. but not in the Chalk Fuel Co.

Mr. J. P. VALETTA said that Col. Eaton was sincerely convinced that the fuel had a future. He was hundreds of pounds out of pocket in the business.

Mr. PERCIVAL CLARKE said that there was no doubt that false statements were knowingly made by the defendants in order to induce people to take shares in the company. The directors of the company could not divest themselves of their responsibility.

On January 20th, the Common Serjeant summed up the evidence and the jury returned a verdict of guilty against all three defendants.

Mr. PERCIVAL CLARKE said that although Sir Charles Herne-Soame was the chairman of the company, Eaton was the ruling spirit. The baronet held his position purely on account of his title. He had been bankrupt twice and for the last 20 years had allowed his title to be used as a bait in connection with doubtful companies.

Detective-Inspector GREER then gave particulars of Eaton's career. He said that he had been promoting companies for 25 years. There were about 50 of these, practically all of them of a doubtful character. Since 1921 twenty-three of these companies and their dummy directors had been traced and seven of them were or would be wound up compulsorily. Eaton's usual method was to buy up or promote small companies, and having issued a large part of the capital to himself for fictitious considerations, proceed to foist shares on the public by means of false prospectuses, &c. The prospectuses issued contained promises, half-truths and "puffs," but very rarely was there any definite mis-statement of facts. If a shareholder threatened active proceedings, Eaton would re-purchase his shares at a discount and dispose of them once again by an "offer for sale" or prospectus. Many pitiful letters had been received from people who had invested their savings in Eaton's concerns. He was formerly in the Army but was called upon to resign his commission in December, 1915. At an electricity inquiry in 1925 the Barford Electric Supply Co., one of Eaton's companies, was involved, and Eaton was described during the proceedings as a "super-crook."

In passing sentence, his LORDSHIP said that there was no doubt who was the instigator of the whole business. Eaton was a serious danger to the community and he would be sentenced to four years' penal servitude. He regretted Soame's position, but he would have to be taught that people must not allow their titles to be used for extorting money from the public. Harley was also under Eaton's thumb and merely did as he was told. These two defendants would be sentenced to six months' imprisonment in the second division.

Row v. Wareham Electric Supply Co. and Others.

THIS case was mentioned before Mr. Justice Rowlatt in the King's Bench Division on January 19th, when an application was made for a fortnight's postponement on behalf of one of the defendants. Counsel for the defendant explained that his client was involved in proceedings at the Central Criminal Court. In reply to his Lordship, he said his client was in the dock there.

Mr. R. J. WILLIS said that the action was for alleged fraud in connection with the company's shares. Since the action was commenced the company had gone into liquidation. His Lordship said that the case would come into the end of the next week's lists.

British Thomson-Houston Co., Ltd., v. Davy.

MR. JUSTICE RUSSELL, in the Chancery Division on January 20th, heard a motion by the British Thomson-Houston Co., Ltd., for an injunction restraining the infringement by W. Davy, Leeds, of its leading-in wire and gasfilled patents relating to incandescent electric lamps.

The defendant did not appear, and evidence was given of the purchase of the infringing lamps at an address at East Parade, Leeds.

Burndept Wireless, Ltd.

MR. JUSTICE ROMER, in the Winding-Up Court, on January 23rd, had before him the petition of Mr. Eric Ball, managing director of John Boulton & Co., Ltd., for the compulsory liquidation of Burndept Wireless, Ltd.

Mr. CLAYTON, K.C., for the plaintiff, said he was a judgment creditor who had made the statutory demand for payment of his debt, and it had not been complied with.

Mr. GAVIN SIMONDS, K.C., for the respondent company, said that the petition was opposed by it and a large majority of the shareholders. The petition was very prejudicial to the interests of the company, whose business was being carried on by a receiver and manager for the debenture holders.

Mr. CLAYTON asked for an adjournment to deal with an affidavit which he was told the respondent company was about to file.

The petition was adjourned for a week.

Reviews.

The Fourth Power Kink Book. Compiled from recent issues of *Power* by the Editorial Staff. Pp. vii+232; fully illustrated. London: The McGraw-Hill Publishing Co., Ltd. Price 7s. 6d. net.

The efficient operation and maintenance of power plant is a work involving a considerable amount of engineering skill and ingenuity, and in the ordinary course of events the plant engineer is absorbed in his calling and seldom finds the necessary time to publish his methods or the particular ideas he has evolved in connection with the machinery under his care.

In order that many of the ideas originated by power plant engineers should be available to their fellow men, the editors of *Power* have for years past devoted some of the columns of their journal to "Ideas from Practical Men," and such has been the appreciation of this section that some two hundred of these recent ideas or kinks have now been published in a volume under the title of the Fourth Power Kink Book.

The work is conveniently divided up into some nine sections dealing with engines, boilers, piping, electrical plant, internal combustion engines, gauges, refrigerating plant and miscellaneous items, and an index is provided. Although American terminology is naturally employed throughout the text, the large number of excellent illustrations serve to simplify matters very greatly, and the practical engineer should have no difficulty in grasping the essential facts despite the differences in workshop practice which exist between this country and the United States.

The first section of the book deals with engine room matters and comprises some thirty-seven pages of these so-called kinks or ideas relating to steam engines, turbines, foundations and other items; it is followed by a section on boiler room operation which is thoroughly practical throughout, dealing with a diversity of hints from safety valves to combustion and testing kinks.

Kinks in pumps is the subject of the next chapter, and useful notes are given on operation and maintenance matters in this all too brief section. The fourth section is entitled "Kinks in Pipes and Piping," and it is here that perhaps the American use of the word kink becomes ludicrous to the British engineer. However, despite the somewhat eccentric title of the chapter, some quite useful hints are given on pipework and particularly on steam pipe lagging.

The section devoted to electrical kinks embraces some fifty-four pages and contains some excellent hints on troubles with a.c. and d.c. motors, switchgear, cables and other apparatus, and one could wish that the text was extended to at least a hundred pages or that a separate volume of electrical kinks was available.

Section VI consists of twenty-two pages devoted to internal combustion engine kinks, and includes some useful notes on Diesel engine maintenance.

A brief chapter on gauge kinks is followed by Section VIII, which comprises a series of practical kinks on refrigerators, dealing with both operation and maintenance matters. The final section of the book is entitled Miscellaneous Kinks, and contains numerous useful items which have proved to be somewhat difficult of classification.

In a brief review of this nature, it is rather difficult to bring out the salient features of a purely practical handbook which cannot fail to be of real service to power plant engineers in general, and the excellent illustrations and moderate price of the volume greatly enhance its value. L.M.J.

Underground Systems for Electric Light and Power. By T.C. RUHLING, M.Am.I.E.E. Pp. viii+346; figs. 221. London: McGraw-Hill Publishing Co., Ltd.

Read with an open mind this work should prove particularly instructive. The title may be somewhat misleading, as the greater portion of the book is devoted to the excavation work and housings for cable systems: "cable installation" might have been a better choice. Nevertheless, it is a useful work and probably unique in regard to the detail of the practical work covered. It must be borne in mind that it deals throughout with American practice, much of which perhaps will not meet with approval in this country, but the wise reader will not be impatient on this score. Credit is due to the author for his treatment of a point which is often sadly neglected, in this country at any rate—that concerning the behaviour of the workman, particularly the foreman. Courtesy to the casual inquirer is strongly urged.

While in many cases at home the actual construction work of manholes and the like does not directly concern the engineer, yet he will find in the pages dealing with this point much information of a guiding value. The importance of recording costing data is stressed and many examples are given of cost analysis for various jobs undertaken. The design problems for the points of entry and exit of cables in conduit systems are covered, and some excellent informative illustrations are given of examples of good and bad cable installations, particularly in connection with manhole rackings. It is a little disappointing to find in a book of this description the subject of cable handling dismissed in a paragraph of 50 or so lines, although the care of the cable is referred to in the various chapters. A 38-page chapter deals with cable splicing, but perhaps the principal value of this lies in the insight which it offers to American practice. The book as a whole should prove an asset to those interested in cable installation generally.

Experimental Electrical Engineering. By V. KARAPETOFF. Vol. II. Third Edition. Pp. xxxii+20; figs. 621. London: Chapman & Hall, Ltd. 1927. Price 25s. net.

This volume of Prof. Karapetoff's well-known work contains an amplification of the subject matter of Vol. I., and deals with the more advanced branches of electrical technology from the points of view of the laboratory and the test bed. It consists of directions for the carrying out of a large number of experiments, these directions being supplemented by a very copious treatment of the theory involved. Notwithstanding that the book is distinctly of an advanced character, the style is by no means academic, and the mathematics is not unduly difficult. The treatment is thoroughly up to date, and many matters, outside the scope of the usual text books, will be found to have been dealt with.

The opening chapters of the work are concerned with measurement of capacity, a.c. bridge tests, and the conditions

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for resonance in a.c. circuits. There is a useful study of the characteristics of long transmission lines, and a good practical chapter on insulation and fault-localisation tests. The calculation of three-phase circuits is dealt with very fully, and this section affords useful illustration of the symbolic vector method of calculation. The chapter on the resolution of unbalanced three-phase systems into symmetrical components of opposite phase sequence is particularly acceptable, as information on this useful method of calculation has hitherto been available only in original papers and articles. Transformer connections are studied in detail, and there is a very informative chapter on harmonics in polyphase systems. The theory, characteristics, and operation of synchronous a.c. machines is exhaustively treated in four lengthy chapters. Two chapters are devoted to the rotary convertor, the starting and voltage regulation of this machine being well covered. The study of the polyphase induction motor is prefaced by a chapter on the theory of the rotating field. The speed and power-factor control of the induction motor receive due notice, and there are brief but interesting references to the induction generator and the phase convertor, and also the operation of induction motors under abnormal conditions. The single-phase induction motor is treated by means of the rotating field and the transformer theories. Two chapters are allotted to the a.c. commutator motor. Further chapters deal with control gear for induction and d.c. traction motors, rectifiers of the mercury-arc and the thermionic types, and with oscillograph and high-frequency measurements. The chapter on harmonic analysis is somewhat disappointing, and this subject is perhaps the only one dealt with by the author of which it can be said that the treatment is scanty and inadequate. There are numerous references to original papers, and an excellent index.

It has been impossible, within the compass of a brief review, to do more than convey an idea of the wide scope of this book and the penetrating character of the treatment of the subjects it deals with. Although primarily a handbook of electrical testing, it is not unfitted to rank as a standard treatise on advanced a.c. technology. Considering its scope and the quantity of matter it contains, the price of the work is certainly very reasonable.

The Mechanism of Standard (or Predetermined) Cost Accounting and Efficiency Records. By THOMAS DOWNIE, Jun., C.A. Pp. 114. London: Gee & Co., Ltd., 1927. Price 15s. net.

One's first thought after having read Mr. Downie's book is "How very complicated it all sounds," but the reader should not allow this idea to prevail. Anyone who has ever attempted to commit to paper a description of even the simplest system of any kind knows how much has to be said in order to convey a clear picture, and how very much more complicated it looks when written down than it actually is in operation.

We feel that anyone who is not a trained accountant, or who is not exceedingly familiar with the accountants' mental processes, will find much of this book difficult to follow. One realises at once that the author is an accountant without having to look at the letters after his name; the professional phraseology pervades the whole. This is unfortunate, and will tend to put off, or, at all events, make difficult a clear understanding of the systems described, to most of those who should otherwise be interested—those, in fact, whom the author no doubt hopes to influence and to persuade to adopt his methods. We refer to manufacturers in particular, and they have not as a rule been educated in the same school as the author.

Most managers of factories, the men who will have to be convinced before standard or any other type of costing systems can succeed in their factories, are quite unable to think in terms of debits and credits, or to appreciate quickly the significance of variance and usage accounts. If such men are to learn from books like Mr. Downie's, accountants must talk and write and describe things in language familiar to them, instead of expecting the managers to study accountancy in their spare time! Costing can all be carried out perfectly well without a suggestion of debits and credits ever coming into it at all, and much more simply.

The author tells us, in his preface, that he has seen in operation, and has been convinced of the thoroughly practical nature of, the standard cost accounting of which this book is a description. If what he has seen has been more than the mere gloss on the surface, and if, in fact, he has been really convinced of the practical nature of the system, he must have come across the practical difficulties, and it is much to be regretted that he has made so little reference to their solution.

Perhaps one of the chief difficulties is that caused by work-in-progress, or, in other words, stocks of part-finished work. The only reference to this point that we can find is on page 20, where he says: "Assuming that no stock remains on hand, and all production is sent to finished goods store . . ."—a state of affairs which never occurs in practice!

This is the rock upon which work in progress accounts, such as those shown in Form B12, usually breaks down. Are the figures representing the balance of work in progress shown there in pounds sterling really borne out by a corresponding quantity of goods on the floor of the shop? There is no means of knowing until a physical stocktaking is made at the end of the year, during which time we have known large and mysterious discrepancies to creep in. Work in progress is a real practical difficulty, and Mr. Downie would have done good service had he enlarged upon this point, and, incidentally, would have assured a much larger public for his book.

Nevertheless, we are convinced that the underlying principle recommended and described in the book is sound, and its adoption would benefit many firms whose products admit of costing on these lines, as, for instance, motor-cars, standard bodies, and parts.

The principle is the setting-up of standards of comparison for everything done in the factory, so as to be able to judge whether actual performance is worse than, equal to, or better than that standard. The relation between actual and standard is expressed as a percentage, the standard being regarded as 100 per cent. Standards are fixed for the time taken to perform each operation. These are not simply average times, but times which any good workman, making the best use of the equipment provided, and working diligently, should require for the job.

From this standard wage costs are fixed, and standard expenses. Actual times and wages, either operation by operation, or in bulk, can be compared with these, and an efficiency figure—the ratio between actual and standard—deduced.

Standard quantities of material from which, say, 1,000 articles ought to be made, provided there is no undue waste, are also fixed, and from them standard material costs. Actual quantities of material used can be checked against these standards, and waste immediately detected.

This same theme pervades all the three systems described, and cannot fail, as the author says, to promote efficiency and provide a measure of it. The difficulty is often to persuade works managers and others to use these comparisons and efficiency figures to get after the men who have been wasting time and materials, and find out the reason, though that is no fault of the cost system.

There is no doubt at all, in fact it is obvious, that these methods will effectively point out wastages, and point them out the moment the job or operation is finished withal. If only the works management staff can be stimulated to use the information so provided and go immediately to find out the why and wherefore of extravagant waste, and do all they can to prevent it happening again, they will be many many times more usefully employed than simply going about seeing what they shall see—what the workmen don't mind them seeing and seldom anything the workmen don't want them to see.

Electric Power Equipment. By J. G. TARBOUX, M.I.E.E. Pp. xi+455; figs. 374. London: McGraw Hill Publishing Co., Ltd. 1927. Price 25s. net.

This book, which, as the author says in his preface, is intended as a text book for electrical engineering students, will be of interest to English readers chiefly as a review of current American practice in the field of the generation and transmission of electrical energy. The ground covered is too wide to render possible anything but a treatment which on the average is superficial, although several matters are dealt with in considerable detail and with due consideration for theoretical principles.

After a brief introductory chapter outlining the present trend of electrical development, the author reviews modern types of generating plant, and devotes a useful chapter to load curves and their significance. A lengthy and heterogeneous chapter follows, in which are successively treated the operation and characteristics of d.c. and a.c. generators, and the leading features of modern types of converting plant. It is rather a pity that the author did not proceed somewhat further with his enlightening sketch of the operation of frequency changers in parallel. An explanation of the method of load division between such machines, and a consideration of the effect of variation of the d.c. excitation of the generating component would have been instructive to the student. The important subject of the excitation of synchronous machines, and of automatic voltage regulators, is well treated in a separate chapter. A little more space might have been devoted to the matter of switchgear equipment. The lack of reference to armourclad gear is noticeable. The subject of transformers and transformer connections is dealt with in considerable detail. A short chapter on electrical instruments and meters is followed by a detailed treatment of the calculation of short-circuit currents. This section, illustrated by worked-out numerical examples, will be found useful by students. Considerable space is devoted to the theory of transmission-line calculations, and a good practical account of present-day practice on erection work is given. The wide subject of automatic protection is somewhat scantily treated. Disturbances on transmission lines and protection against the same receive two chapters. The notes on sub-stations and distributing systems are somewhat superficial. An elementary chapter on tariffs concludes the work.

It will be gathered from the foregoing brief review of the contents of the book that the treatment is far from homogeneous. Certain matters are dealt with thoroughly and in considerable detail, whilst others are treated so scantily that the references will be of little value to the student. As a work of reference for the general engineer the book should have some value.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A. Circle Campaign.

The latest progress report shows that numerous lecture arrangements have been added to the programme. The "panel" now bears the names of 220 lecturers and lecture secretaries and 207 lecture engagements have been arranged. Up to date 97 demonstration houses, exhibitions, and special demonstrations have been reported. The latest are an electric house at Monkseaton, and an exhibition at Sutton Coldfield.

Municipal Trading Rejected at Derby.

The Town Council has, by 26 votes to 23, rejected a proposal that all the powers conferred by Act of Parliament for the development of electricity in the borough should be utilised, and that the Electricity Committee should be requested to report particularly on the Corporation undertaking the internal wiring of premises, the sale of fittings, and the hiring out of all kinds of electrical appliances. The motion was opposed on the ground that the suggested work would enter into competition with private traders.

Amalgamations in Italy.

It is reported from Rome that the Società Italiana di Elettrochimica, of Rome, which has a share capital of 42,000,000 lire, has decided to amalgamate with the Società Meridionale di Elettricita, of Naples, whose capital of 300 million lire is to be increased to 450 millions. The fusion is facilitated by the provisional exemption from taxation of amalgamations of Italian companies. This circumstance is also assisting the absorption by the Società Dinamo, of Milan, which belongs to the Brown-Boveri group, of four smaller undertakings which are dependent upon it.

Social Events.

Each year sees an augmentation in the numbers attending the annual dinner of the staff of the Osram-G.E.C. Lamp and Glass Works and the M.O. Valve Works, and a very large company gathered at the Café Royal on Friday last. In accordance with custom, Mr. Chris. Wilson occupied the chair; a number of the directors of the General Electric Co., Ltd., supported him, but the chairman, Sir Hugo Hirst, was prevented by ill-health from attending. The toast of "The G.E.C." followed that of "The King and Royal Family." Mr. V. Myatt, who proposed it, spoke of the good relations existing between the management and the staff, saying that the company recognised fully the benefits of social activities and research. Mr. Wilson, in the course of replying to the toast, referred with regret to Sir Hugo Hirst's absence. Sir Hugo's annual speech, he said, gave them encouragement for another year. The speaker briefly reviewed the general activities of the company and then dealt more fully with the lamp business. He stated that the admission of many other firms on an equal footing had made competition very severe but he felt that the staff would rise to the necessity for obtaining greater sales of "Osram" lamps. Mr. W. Franks eloquently proposed the toast of "The Visitors and Press" and expressed the company's regret at the death of Mr. Sidney Rentell. Mr. J. Y. Fletcher, in the course of a long reply, said that although the number of "Osram" lamps sold last year was greater than ever before, the works could have produced a far greater number. He detailed the many directions in which the company and the E.L.M.A. were endeavouring to stimulate the sales of lamps. Among these were the guaranteeing of lamps for street lighting; as one result of this the company had secured the order for the whole of the street lamps in Brighton. The Association was applying for an Order under the Merchandise Marks Act requiring the marking of imported lamps with the name of the country of origin. The speaker pointed out, among other things, that the tendency in the commercial world to form large combines involved the disappearance of many small customers and the advent of a very few large concerns which the company had to endeavour to secure as customers. Mr. Keir (*Electrical Times*) replied for the Press. Mr. J. T. Turner wittily proposed the chairman's health, and Mr. Wilson made a brief response. The second part of the evening was devoted to an excellent concert by a number of capable artistes.

On the invitation of Mr. and Mrs. R. E. Robson, the employés of Robson & Coleman, Newcastle-upon-Tyne, attended their 17th annual whist drive, dance and supper, at The Minories Assembly Rooms, Jesmond, on January 20th. The company numbered about 120. During the proceedings a gold watch was presented to Mr. Robert Graham, who has completed 21 years' service. He is the tenth employé to receive such a memento.

Commercial Travellers.

The annual dinner of the Electrical Trades' Commercial Travellers' Association will be held at the Connaught Rooms on February 10th; Sir Herbert Morgan, the president, will be in the chair. The hon. secretary of the Association, Mr. W. Stoker, 59, New Oxford Street, W.C.1, will gladly send particulars of membership and its advantages.

The National Union of Commercial Travellers has arranged a discussion to be held to-night (Friday), at 7 p.m., at the British Commercial Travellers' Club, 24-28, New Oxford Street, W.C., on "Terms and Conditions of Employment: Is Negotiation Desirable?" The president of the Union, Mr. H. Ward, of Liverpool, will open the discussion, and the proceedings are open to all commercial travellers.

Wages in the Engineering Industry.

The temporary agreement regarding wages in the engineering industry expires at the end of this month. Consequently a meeting of representatives of the trade unions concerned was to be held in London yesterday to consider future policy. It is thought, in view of the London demand for a pound a week increase, that higher rates will be pressed for at the next meeting with the employers.

Manchester Tramway Electricians.

At last week's meeting of the Manchester City Council a minute of the Workmen Special Committee was referred back. This related to a proposal by the Electrical Trades Union that a set of working conditions should be agreed upon between the Tramway Department and the electricians employed by it in accordance with the terms of settlement in a recent dispute. The Workmen Special Committee declined to agree to this. During the discussion upon the matter, Ald. Walker said that the Committee would be advised to utilise the existing national and district machinery rather than negotiate a separate agreement.

Employment during December.

The January *Ministry of Labour Gazette* states that although employment in the engineering industry during December was still slack on the whole, there was a further slight improvement in most sections. The overall figure of unemployment fell from 9.0 to 8.5 per cent., while in the electrical engineering section the decline was from 4.3 to 4.2 per cent. In the electrical wiring and contracting industry, however, there was an increase in unemployment, from 5.0 to 5.4 per cent. The electric cable, wire and lamp manufacturing group showed an improvement, the proportion of unemployed falling from 5.2 to 4.6 per cent. The actual numbers of unemployed in the industries referred to were as follows on December 19th:—Engineering, 84,964; electrical engineering, 3,298; electrical wiring and contracting, 794; and cable, wire and lamp manufacture, 3,925. While we propose to deal more fully with employment during 1927 in our next issue, we may say that upon the whole there has been definite improvement generally and also in those sections of industry with which we are concerned. During December employment in engineering, electrical engineering and electric cable, wire and lamp manufacture reached the highest points of the year. While this cannot be said of the wiring and contracting industry, the improvement in this branch was very marked in the last three or four months of 1927.

New Australian Company.

The Electricity Meter Manufacturing Co., Ltd., has been registered in Sydney, N.S.W., with a nominal capital of £300,000.

Czecho-Slovakian Electrical Imports.

During November last, according to the *Board of Trade Journal*, electrical machinery and tools to the value of 25,000,000 crowns (£152,400) were imported by Czecho-Slovakia.

New Zealand's Electrical Imports.

The *Board of Trade Journal* states that the imports of electrical appliances and machinery into New Zealand during the September quarter of 1927 were valued at £587,218. Of this the United Kingdom provided £359,374, the United States £124,722, Canada £20,286, and Australia £12,017. It is noteworthy that this item was the second highest in the import list, being exceeded only by cotton piece goods.

Unemployment.

There was a large fall (104,200) in the number of registered unemployed during the week ended January 9th. At that date the total stood at 1,232,100, as compared with 1,336,300 on January 2nd, and with 1,432,000 on January 10th, 1927. The large decrease has not yet been explained, but it may be due, to some extent, to the institution of the new Old Age Pension scheme, under which the age for the pension is reduced to 65, and persons receiving it are no longer eligible for unemployment benefit.

New French Companies.

Among the companies recently organised in France are the Compagnie des Produits Electrolytiques, Paris (14, Rue du Cardinal Mercier), capital, 1,200,000 fr.; and the Société des Moteurs Electriques Douro, Strassburg (2, Rue Charles Grad), capital 410,000 fr., to manufacture a newly-patented double-stator double-rotor single-shaft electric motor.

Italian Hydro-Electric Finance.

The Milan correspondent of *The Times* reports that the Italian Government has given its authorisation to the participation of a group of Italian industrialists and financiers in the constitution of a new holding company to be formed in the United States. The company will hold exclusively stocks of the chief Italian hydro-electric companies for a total amount of $30,000,000, representing 10 per cent. of the amount of the nominal capital of all the Italian companies concerned. The *Corriere della Sera* states that the company is so constituted that any danger of the influence of foreign capital on one of the most prosperous Italian industries has been eliminated. Two results are expected from the new undertaking—a more rapid hydro-electric development and a greater equilibrium in the exchange and in the balance of payments.

Local Exhibition.

BATH.—An electrical exhibition, organised by local tradespeople and contractors and the Corporation Electricity Department, was opened at the Assembly Rooms on January 14th by Capt. C. T. Foxcroft, M.P., and is to remain open for a fortnight.

American Domestic Appliance Sales.

In its January issue, *Electrical Merchandising* sets out the sales during 1926 and 1927 of the chief classes of domestic electrical appliances in the United States. The total sales of 27 classes in 1927 are given as $744,104,500, as compared with $763,088,000 in 1926. In both years incandescent lamps occupied the first place, but the value fell from $170,000,000 in 1926 to $160,000,000 in 1927. Washing machines were again second, and in this case sales fell from $124,000,000 to $118,500,000. The principal increase occurred in refrigerators, from $65,200,000 to $82,125,000. The numbers of articles sold are also given, and a few cases may be quoted. In 1927 the sales included 538,000,000 lamps (against 500,000,000 in 1926); 790,000 washing machines (843,000); 365,000 refrigerators (248,000); 3,000,000 irons (3,000,000); 625,000 toasters (600,000); 6,000,000 portable lamps and shades (6,000,000); 13,000,000 "residential fixtures" (13,000,000); commercial lighting units, 1,800,000 (2,000,000); and vacuum cleaners, 1,028,000 (1,065,000). In the same issue our contemporary illustrates the "saturation" of the markets for the leading appliances. It is shown that while 87 per cent. of the 17,596,390 wired homes of the United States have electric irons, only 1.98 per cent. use electric ironers. About 40 per cent. have vacuum cleaners, 28.4 per cent. have electric washers, 27.85 per cent. fans, 25.8 per cent. toasters, 14.8 per cent. heaters, 5.4 per cent. cookers, 4.3 per cent. refrigerators, and 3.35 per cent. ranges.

Calendars and Diaries.

A pocket diary for 1928 received from the ELECTRICAL TRADES COMMERCIAL TRAVELLERS' ASSOCIATION contains a great deal of local information of service to commercial travellers, the lengthiest tabular section being one setting forth market and early closing days, also distances from London, population and posting times, in respect of numerous places in England and Wales, Scotland and Ireland.

A most useful composite desk blotting, memoranda, and diary pad and wallet has come to hand from the HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., and the HEWITTIC ELECTRIC CO., LTD., of Hersham, Walton-on-Thames, Surrey.

The 1928 diary of the PORTLAND CEMENT SELLING & DISTRIBUTING CO., LTD., is a very serviceable pocket book. It is prefaced by a great deal of technical and general information, and it has ample memoranda space and a supply of decimal-squared paper.

A neat wall calendar has been sent us by Messrs. GEORGE NOBBS, LTD., 89, Cleveland Street, W.1. A set of monthly date slips is surmounted by an attractive etching.

The SHROPSHIRE, WORCESTERSHIRE & STAFFORDSHIRE ELECTRIC POWER CO.'s calendars are always notable productions, and the 1928 one maintains the standard. A beautifully-coloured drawing of a young lady forms the subject, and the monthly date sheets show lighting-up time for every day.

Trade Announcements.

The B.I. SYNDICATE, LTD., 45-48, Carlton House, Lower Regent Street, S.W.1 (manufacturers of "Astro" reflectors, &c.), states that, at the request of the British Insulated Cables, Ltd., it has changed its name to "Electro Rays, Ltd.," in order to avoid confusion due to the similarity of the previous title with the trade mark of the British Insulated Cables, Ltd.

Mr. T. A. ROSE, M.I.E.E., states that he is still continuing in his own name at 25, Milton Street, E.C.2, the premises occupied for many years by Rose Bros. Electrical Co., Ltd. (in liquidation), of which he was managing director. He is dealing in the same electrical goods as the company used to supply.

The telephone numbers of the JACKSON ELECTRIC STOVE CO., LTD., have been altered to "Sloane 6248-49-50."

Messrs. ALLAN & MAYES, electrical engineers, have opened a showroom at Burlington Buildings, Cow Wynd, Falkirk.

New Catalogues and Lists.

MESSRS. HOUGHTON-BUTCHER (GREAT BRITAIN), LTD., 88-89, High Holborn, W.C.1.—"Houghtons Radio News" for January, containing prices and details of radio apparatus.

MESSRS. W. CANNING & CO., LTD., Great Hampton Street, Birmingham.—Catalogue No. 1927 (724 pp.), a very comprehensive catalogue of equipment for electro-plating, polishing, bronzing, lacquering, and enamelling. A great deal of information regarding processes is given, and the publication is thoroughly illustrated.

SOLEX, LTD., 223-231, Marylebone Road, N.W.1.—A priced leaflet advertising the "Solex" petrol filter.

HIGGS MOTORS, Witton, Birmingham.—January-February stock list of a.c. and d.c. motors. Priced.

BRITISH INSULATED CABLES, LTD., Prescot, Lancashire.—Publication P.225, a new price list of "Prescot" jointing materials and accessories.

MESSRS. A. EMANUEL & SONS, LTD., 9-13, George Street, Manchester Square, W.1.—Catalogue E, a well-illustrated price list of high-class electric lighting fittings—electroliers, bowls, standards, brackets, &c. A large selection of accessories is included.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—An illustrated description of the use of "Chloride" batteries at the Round Island wireless beacon station.

WAGNER ELECTRIC SUPPLIES, LTD., 66, Victoria Street, S.W.1.—An illustrated pamphlet dealing with a new split-phase induction motor (⅛, ¼, and ½ h.p.) primarily designed for washing-machine service.

MESSRS. WHEELER & ESSER, 7, Upper Marylebone Street, Great Portland Street, W.1.—A price list of electric candle tubes of various kinds and colours.

METROPOLITAN-VICKERS AUSTRALIA PTY., LTD., Sydney and Melbourne.—Two illustrated leaflets dealing with outdoor switchgear and heavy-duty isolating switches.

THE IRON & NICKEL BATTERY CO., LTD., 17-19, Cockspur Street, S.W.1.—A folder describing the "Ionic" hand inspection lamp.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—A painting book for children, telling in rhyme the adventures of one "Sir Eddy de Swan."

Bankruptcy Proceedings.

J. D. CHISHOLM, lately of 34, Gordon Square, W.C.—The public examination of this debtor was held on January 18th before Mr. Registrar Warmington at the London Bankruptcy Court, the accounts showing total liabilities of £976 (unsecured £430) and assets valued at £4,154, representing the estimated surplus from security in the hands of a fully secured creditor. Replying to the Official Receiver, debtor said the receiving order was made against him on October 20th, 1925, and was rescinded in February, 1926, on the ground that all his debts had been paid in full. The latter order was withdrawn in March, 1927, on the application of a creditor for £100, whose claim had not been disclosed or paid, and the receiving order was reinstated. A sitting for his public examination was appointed for April 13th, 1927, but he did not attend and was arrested under an order of the Court. In 1922 he secured a provincial agency for a London firm of electrical engineers and took offices in Leeds. This was a failure and was discontinued in June, 1923. During the next 15 months witness was employed by another firm of electrical engineers. In October, 1924, he formed Secret Wireless, Ltd., with a nominal capital of £10,000, to which, in consideration of £4,500 in shares, he transferred various wireless and electrical inventions for which he had taken out patents. He was appointed managing director at a remuneration of £1,000 per annum, but the amount was reduced first to £500, then to £250, and latterly he had not received anything. In December last a resolution was passed for the voluntary liquidation of the company with a view to reconstruction. Witness attributed his failure to ill-health and to heavy personal expenses. His shares in the company were in the hands of his solicitor; a parcel of 1,500 shares had been sold to provide the money with which certain of his debts were paid early in 1926. The value of the shares was dependent upon the future of the company. The examination was concluded.

I. J. LITHAUER, 10, Duke Street, Adelphi, W.C., and 223a, Maida Vale, N.W.—This debtor attended last week before Mr. Registrar Francke at the London Bankruptcy Court for public examination. The receiving order was made last October and accounts have been presented showing total liabilities of £5,395 (unsecured £5,321) and assets nil. Replying to Mr. Allcorn, Assistant Official Receiver, the debtor stated that a previous failure was recorded against him in May, 1925; the liabilities then amounted to £5,216; no dividend was paid, and he had

not obtained a discharge from the bankruptcy. He was subsequently employed as a salesman, but was appointed managing director of a company entitled "Gil-Ray Trading Corporation, Ltd.," and acted in that capacity until a receiver for the dbenture-holders was appointed in November, 1926. Witness next became managing director of a company dealing in wireless instruments and accessories, but that concern ceased to trade in June, 1927, and he was without occupation until the date of these proceedings. The examination was concluded.

H. B. A. ROSENSHEIN (known as Henry Rose), 80, Maida Vale, W.—The public examination of this debtor was held last week at the London Bankruptcy Court before Mr. Registrar Mellor, the accounts showing liabilities of £5,042 and assets nil. In the course of his evidence the debtor stated that in 1922 he lost £2,000 in connection with a Cairo omnibus scheme. In 1923 he was instrumental in the formation of a syndicate styled "The Egyptian Electric Power Development," which had for its objects the acquisition from the Egyptian Government of a concession for the utilisation of the waterfalls from the Assouan reservoir. The scheme, however, proved abortive and he lost about £1,000. In 1924, he was instrumental in obtaining the sanction of the Egyptian Government for the introduction of the automatic telephone system in Egypt, and as a result a certain English telephone company (from whom he held a commission note) obtained a contract for the installation thereof; in July, 1926, he brought an action against the company claiming commission, and judgment was given in his favour for £2,600 and costs. He had been engaged in other industrial schemes in Egypt, but in November, 1924, as a result of a change in the political situation in Egypt, he was deported. He attributed his insolvency to the failure of his Egyptian schemes, to his liability for £488 under a promissory note which he signed for a friend, and to lack of remunerative employment since 1925. The examination was concluded.

G. INRIG, Church Road, Kingston-upon-Thames, engineer.—An application for discharge by this debtor was heard recently at the Court House, Kingston. The debtor did not attend. It was stated that a receiving order was made against him in October, 1921. The liabilities were then estimated at £363, but the proofs actually admitted amounted to £782, and there were no assets. No dividend had been paid. A previous receiving order was made against him in 1905 in the Guildford court. The debtor had failed to disclose that a receiving order was made against him in the High Court in 1899, when a dividend of 5d. in the £ was paid on debts of £2,981. At the time of his failure in 1921 he was trading as an electrical engineer, and he attributed his failure on that occasion to the cost of litigation in connection with the lease of the premises. The discharge was refused.

A. M. EDWARDS, 111b, High Street, Blackwood, Mon., trading as Mansell Edwards & Co., electrical engineer.—The public examination on January 19th was adjourned. A deficiency of £322 was disclosed. Debtor admitted that he lost £61 in the purchase of cars, which he considered necessary in connection with his business.

E. R. H. SYMONDS, electrician, 40, Victoria Road, Great Yarmouth.—Receiving order made January 11th, on debtor's own petition. First meeting held January 25th, at the Official Receiver's office, 9, Queen Street Chambers, Norwich. Public examination February 7th, at the Town Hall, Great Yarmouth.

H. REES, works electrician, 67, Chase Road, Morriston, Swansea.—First meeting held January 25th, at the Official Receiver's offices, Government Buildings, St. Mary Street, Swansea. Public examination February 10th, at the Town Hall, Swansea.

R. C. ADCOCK, 40, Vicarage Street, Walsall, late of Perry Hall, Broad Lane, New Invention, near Wolverhampton.—First meeting January 30th, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton. Public examination, February 29th, at the Court House, Walsall.

T. BARTON, electrical engineer, Electric Works, Ainsworth Street, Blackburn.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, released October 19th.

Company Liquidations.

GILLAN RADIO-ELECTRIC, LTD.—Winding up voluntarily. Liquidator, Mr. W. G. Ansele, 64, High Holborn, W.C. A meeting of creditors was held on January 23rd.

HALL TELEPHONE ACCESSORIES, LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. C. J. Light, 70, Dudden Hill Lane, Willesden, N.W., who is authorised to consent to the registration of a new company to be named Hall Telephone Accessories (1928) Ltd. A meeting of creditors is called for February 2nd at the liquidator's offices. (This notice is purely formal as all creditors have been, or will be, paid in full.) Particulars of claims by March 3rd.

NOTABLE ELECTRIC CO., LTD.—Winding up order made by the High Court on January 16th.

L. WEEKES, LTD.—The liquidator, Mr. B. T. Crew, George Street West, Luton, announces a final dividend of 1s. 10d. in the £, making a total of 5s. 10d. in the £.

Private Arrangements.

A. H. MARSH, electrical engineer, 9, Bank Street, Ossett.—A meeting of creditors was held recently, when a statement of affairs was presented, which showed ranking liabilities of £2,010 and assets of £819, leaving a deficiency of £1,191. The debtor started trading in January, 1920, with a capital of £180. He had previously been in employment as a colliery electrician. For a time the debtor was in partnership, but a dissolution took place in 1922, and he traded alone until 1925. He then took another into partnership, but subsequently again traded on his own account. The trading figures showed that the business paid its way up to April of last year. The drawings had been at the rate of £4 or £5 per week. At cost the stock amounted to something like £1,200. It was decided to confirm the deed of assignment already executed to Mr. W. Oddy, Ossett, and a committee of the principal creditors was also appointed.

A Report upon Uruguay.

The Department of Overseas Trade has issued through the Stationery Office (1s. net) a report upon conditions in Uruguay, by the Hon. E. S. Scott, C.M.G., M.V.O., Consul-General at Montevideo. In the course of this it is stated that the principal competition in electric cables and accessories comes from Germany. The Uruguayan market is not a large one and agents usually need to hold several agencies in order to secure an adequate return for their efforts. The appointment of one agent for both Uruguay and Argentina is not advised. British exporters should keep their agents well supplied with catalogues printed in Spanish and bearing the agents' names. During the first six months of 1927 the imports of electrical goods and apparatus reached a value of $491,234.

Among the prospective developments mentioned in the report is a scheme for the harnessing of the Rio Negro. A Swiss expert has been asked by the Government to prepare a report, and it is believed that a dam and a generating station with a capacity of 50,000 h.p. could be constructed for 6,900,000 pesos and that it could be equipped and the transmission lines erected for a further 8,100,000 pesos. It is improbable, as has been suggested, that the plant would be able to supply Montevideo, 300 km. away.

Recent Contracts.

The important order for electric traction equipment recently placed by the London Underground Railways with the GENERAL ELECTRIC CO., LTD., has been considerably increased and now comprises in all 920 traction motors, each of 240-h.p. capacity, and "automatic acceleration" control equipment for 63 motor coaches and 107 trailer cars. This is claimed by the company to be the largest single order ever placed in this country for electric railway motors.

The "Magnet" electric draw plate bread baking oven installed in the premises of the United Co-operative Baking Society at Glasgow by the GENERAL ELECTRIC CO., LTD., has been so successful that the Society has given an order for two similar ovens. Since the original oven was started, over half a million loaves have been baked without a single rejection.

The General Electric Co. also announces that it has received a contract from the Director of Navy Contracts for the supply of over a quarter of a million vacuum and gasfilled electric lamps.

The Railways and Road Transport.

The Federation of British Industries has decided to offer strong opposition to the Bills which the railway companies are promoting to secure powers to run road vehicles. The F.B.I. contends that the result of these Bills will inevitably be that the railway companies will crush the competing carriers and then put up their road rates with a view to protecting their interests as railways, thus both keeping up the rail charges and also increasing road charges throughout the country and removing the most effective source of competition with the railways.

In the course of a statement in reply to the Federation, Sir Herbert Walker, general manager of the Southern Railway, stated that the railway companies could only obtain and keep such a monopoly as suggested by the Federation at the double cost of running an uneconomical road service and of diverting traffic from the railways. It was unreasonable to suppose that they would ever adopt such a suicidal policy. Sir Herbert also said that as ratepayers the railway companies should be allowed to make the same free use of the roads as other ratepayers.

The Industrial Heating Exhibition.

The Industrial Electric Heating Exhibition, organised by the British Electrical Development Association, which is to be opened at the Glaucus Street works of the Poplar Electricity Department on Monday next, January 30th, will prove of considerable interest to both large and small manufacturers. A preliminary programme shows that eleven well-known companies are providing the exhibits. The products of the Electric Furnace Co., Ltd., are too large for display in an exhibition of this nature, and accordingly the company is represented by working models, samples and photographs. Messrs. Marryat and Place will show an electric rivet heater and the Hotpoint Electric Appliance Co., Ltd., glue pots, soldering irons, forge blowers, electric melting baths, &c. Automatic & Electric Furnaces, Ltd., will have a display including an automatic hardening furnace, a high-speed steel hardening furnace, an

air tempering oven, &c. The exhibit of the General Electric Co., Ltd., will embrace a japanning oven, a drying oven, a water still, a wax tank, and other electrically-heated appliances. "Globar" elements and their applications will be demonstrated by the British Resistor Co., Ltd., while the Bastian Meter Co., Ltd., will show models of a.c. and d.c. boilers and an industrial sugar boiler. General purpose ovens for industrial drying and baking processes involving temperatures up to 600 deg. F. will appear on the stand of the Metropolitan-Vickers Electrical Co., Ltd. The "Lecfur" products to be shown by the Leeds Electrical Construction Co., Ltd., will include furnaces, an annealing machine, and a soft-metal melting pot. Other exhibitors will be the British Insulated Cables, Ltd. (a spot welder and a rivet heater), and the Westminster Engineering Co. (welding apparatus). The exhibition will remain open until February 4th.

Receiver Appointed.

CAMPBELL GAS ENGINE CO., LTD., Halifax.—Mr. G. P. Norton, Station Street Buildings, Huddersfield, has been appointed receiver for the debenture holders of this company. This step has been taken to safeguard the position, and to enable the company to carry on pending efforts to reconstruct or dispose of the undertaking. A meeting of creditors was to be held on Wednesday last.

For Sale.

Messrs. Leopold Farmer & Sons will sell by auction, on February 14th and following days, on the premises, the machine tools, engineering plant and equipment of Straker-Squire, Ltd., Angel Road, Edmonton. (See our advertisement pages to-day.)

Book Notices.

"The *Journal* of the Royal Technical College," No. 4, contains a record of some of the research work carried out in the Royal Technical College, Glasgow, by the staff and senior students. The subjects dealt with include "Effects of Surface Layers on Mica Insulation," by J. M. Macaulay; "Diesel-engine Performance on Oils from Coal," by J. S. Brown; "The Air Ejector," by A. D. Third; "Induced E.M.F. in Electromagnetic Machines," by M. G. Lay; and "Methods of Preventing Electrical Apparatus from Starting Explosions in Mines," by G. Hibberd.

"Patents for Inventions," by B. J. King, C.I.M.E. (16 pp.). London: King's Patent Agency, Ltd.—This handbook deals, in addition to the subject of the title, with trade marks, designs and copyright.

"Automobile and Radio Batteries," by H. H. U. Cross. Pp. vii+128; figs. 53. London: Crosby, Lockwood & Son. Price 3s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. LXLVII. January, 1928. New York: The Institute. Price $1.

Aluminium Cable Manufacturing in Japan.

Commerce Reports states that until about two years ago Japan purchased considerable quantities of American aluminium wire, principally for high-pressure electric-power transmission. The development of large Japanese hydro-electric power systems and the rapid increase in voltages created a substantial demand for aluminium transmission lines which competed with the locally-produced copper cables. The big Japanese copper-drawing firms, therefore, purchased aluminium wire from Europe and America for use in manufacturing their own transmission cables. Later, arrangements were made with British and American firms by which Japanese companies obtained the right to manufacture aluminium cable in Japan, the foreign firms supplying the ingots and technical assistance.

Australian Defamation Action.

According to Australian newspapers just to hand, in December, Mr. S. Y. Maling, deputy general manager of the Sydney (N.S.W.) Electricity Department, sued the proprietors and publisher of the Sydney *Sunday News* for £20,000 damages on account of alleged defamation of character. The matter arose out of articles published by the newspaper charging Mr. Maling with irregular conduct in connection with a contract for plant for the department. The jury found in Mr. Maling's favour and awarded him a farthing damages. The Judge refused to grant a certificate of costs, but allowed an order for a stay of proceedings.

Fire.

Considerable damage was done by a recent fire at the premises of Messrs. Malcolm & Allan, Eglinton Street, Glasgow.

New Belgian Company.

A company has been formed at Liége (19, Rue du Paradis) with a capital of 1½ million francs and the title La Société des Constructions Electriques Hazemeyer, to acquire and carry on an electrical engineering undertaking.

Indian Duty on Radio Apparatus.

The Government of India has modified the customs duty on imported radio apparatus and components. The effect of the new measure is to permit importation into British India of these articles at a customs duty of 2½ per cent. *ad valorem*.—*Reuter's Trade Service* (Bombay).

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price January 24th.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	3½d. to 4d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£13 10s.	...
a	Sulphur, Commercial	,,	£11	...
a	,, Roll	,,	£11	...
a	Soda, Chlorate	per lb.	3d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	3¾d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£107 to £112	...
b	,, Wire	per lb.	1/6 to 2/-	...
b	,, Sheet	,,	1/3 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£237	£3 dec.
	Grade II	,, ,,	£157	£2 dec.
	Grade III	,, ,,	£82	...
c	Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c	,, Tubes (solid drawn)	,,	11½d. to 11¾d.	...
c	,, Wire, basis	,,	9½d.	...
c	Copper Tubes (solid drawn) ...	,,	1/0½	...
c	,, Bars (best selected) ...	per ton.	£92	£2 inc.
c	,, Sheet	,,	£94	£2 inc.
c	,, Rod	,,	£92	£2 inc.
d	,, (Electrolytic) Bars ...	,,	£87	5/- dec.
d	,, ,, Sheets ...	,,	£143 10s.	...
d	,, ,, Wire Rods	,,	£77	5/- dec.
d	,, ,, H.C. Wire	per lb.	9⅜d.	¼d. dec.
f	Ebonite Rod	,,	2/3 to 2/6	...
f	,, Sheet	,,	2/3 to 2/6	...
n	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	6/3	...
h	India rubber, Para fine	,,	1/8½	1d. dec.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	78/-	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£23 fs.	...
g	Mercury	per bot.	£22 2s. 6d. to £22 7s. 6d.	2/6 to 7/6 dec.
e	Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large ...	,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	,,	1/3½	...
p	,, ,, drawn bars & rods	,,	1/3	...
p	,, ,, rolled strip & sheet	,,	1/3½	...
p	,, ,, wire...	,,	1/3½	...
o	Platinum	per oz.	£14 10s.	...
d	Silicium Bronze Wire	per lb.	10½d.	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£250 10s. to £251 5s.	£3 5s. to £3 15s. dec.
n	,, Wire, Nos. 1 to 16	per lb.	4/2	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on January 21st, Messrs. James Forster & Co. stated that the lead market had been a dull and featureless one; in view of the extenuated state of demand, there was no lack of lead for prompt delivery. Any attempt to resell until consumptive demand broadened would inevitably lead to lower prices.

Lighting and Power Notes.

Ashbourne.—OPPOSITION TO ELECTRICITY ORDER.—The Urban District Council is to oppose the application for a Special Order made by the Derbyshire and Nottinghamshire Electric Power Co., and is to apply for an Order to purchase electricity in bulk from the company.

Australia.—VICTORIA.—We have received from the State Electricity Commission of Victoria a copy of the eighth annual report covering the year ended June 30th last. The revenue from all sources amounted to £1,180,993, an increase of £338,388 as compared with the preceding year, but operating expenses, interest and depreciation totalled £1,377,647, as against £1,111,482, resulting in a net deficit of £196,654, as compared with a loss of £268,877 in 1925-26. The capital expenditure during the year amounted to £1,243,961, the chief items being £437,046 on the Yallourn scheme, £263,046 on the main supply system, £195,179 for power station plant and equipment at the Sugarloaf works, and £130,274 for power stations, transmission and distribution systems, &c., in the North-Eastern district. The electrical energy generated or supplied in the Melbourne metropolitan area during 1926 totalled 486,590.916 kWh, and the total for the first six months of 1927 was 253,916.889 kWh. Early in the financial year the last two of the five turbo-generator sets at the Yallourn power station were taken over from the contractors. The maximum load that this plant is designed to carry is

50,000 kW, but towards the end of the year the load had grown to 59,500 kW, and an order was therefore placed for a 12,500-kW set in order to avoid a shortage of power in the winter of 1928. Constructional work in the metropolitan area to provide for the requirements of the system of the Melbourne Electric Supply Co., Ltd., were completed, and the Richmond power station was closed preparatory to the installation there of an 18,500-kW, 3-phase turbo-generator. Seven main sub-stations were erected in the Company's area, of which four have a capacity of 18,000 kVA each, and the remainder are of 3,000 kVA. Considerable progress was made in connection with the Sugarloaf-Rubicon scheme.

Barnes.—LOAN.—The Urban District Council is to apply for sanction to borrow £25,180 for the erection of a 2,000-kW sub-station in Washington Road and the provision of two 500-kW convertors and necessary cables at the East Sheen sub-station.

Bedford.—OPPOSITION TO SCHEME.—The Corporation Electricity Committee has lodged objections to the proposal of the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co. to acquire land at Little Barford for the erection of a generating station on the ground that the station is unnecessary. Should the objection be over-ruled, the Committee proposes that it should be laid down that the station shall not be commenced till the Central Electricity Board has decided that it is to be a "selected" station.

Birmingham.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the following loans:—Mains, £400,000; sub-station buildings, £24,000; and £1,350,000 for the Hams Hall power station.

Bishopbriggs (Lanarkshire). — STREET LIGHTING. — The Lighting District Committee has recommended the acceptance of a tender by the Clyde Valley Electrical Power Co. of £875 for the erection of 20 lamps, with an annual charge for maintenance of £2 7s. 6d. per lamp.

Burma.—HYDRO-ELECTRIC SCHEME POSTPONED.—*The Times* reports that the Government of Burma has been advised to defer its decision on the Yunzalin hydro-electric scheme, which would cost £8,250,000, until the possibility of supplying Rangoon with water at a more reasonable rate has been further investigated.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Plans for the development of additional power to meet the growing requirements of Sault Ste. Marie, Sudbury, and Algoma districts are announced by the Ontario Hydro-Electric Power Commission. The plans of the Commission include the development of 12,000 h.p. on the St. Mary's River, from 125,000 to 140,000 h.p. on the Mississauga River, and 30,000 h.p. on the Montreal River. An application has been received from the Sudbury district for power for the large smelter which is being erected there, and this will be supplied from the development on the Montreal River. When the capacity of the three rivers has been fully developed, the Ottawa River will furnish an additional source of power.

Continued activity in hydro-electric development during the year just entered upon is indicated by official figures showing last year's development and the work now in progress. In 1927 hydro-electric equipment was installed in Canada and ready for operation to the extent of 221,655 h.p., while an additional 78,000 h.p. will be available during the first six or seven months of this year. With the additions during the past year, the total installation in Canada totalled 4,777,920 h.p., which will shortly be raised to more than 5,100,000 h.p. by the installations now in process of completion. In addition to the number of undertakings that are nearing completion, there are a number in the initial stage of construction and others about to be commenced which will result in an addition to the total installation in the Dominion of more than 2,000,000 h.p. This new work will require at the very least a direct investment of more than $200,000,000.

Canary Isles.—LAS PALMAS.—A new electric lighting enterprise, the "Cicer" Company, is about to commence operations at Las Palmas.

Continental.—ITALY.—For more than fifty years the Italian engineers have been discussing the necessity for regulating the waters of Lake Maggiore, a question that interests the Tessin as well as Piedmont and Lombardy, and a final decision was made at the last meeting of the Supreme Council of Public Works, held at Rome. The plan adopted is that put forward by the provinces of Milan, Novara, Pavia, and Varese, and includes the construction of a dam for regulating the falls of the Miernia, near Sesto-Calende, and another at Porta della Torre. In order to ensure the regulation of the Alto-Agro of Novarra, of the Alto-Agro of Milan, and of Nimercate at Tornavente (to the left of the Tessin), the Elena Canal, with a minimum output of 20 cubic metres of water per second, will be constructed, and the Cavour Canal will be put in order. The existing power stations of Vizzola and Turbigo will be enlarged, and it is calculated that there will be a gain of at least 50,000 kW, to be put at the disposal of the various agricultural and business enterprises of Piedmont and Lombardy.

The Milan correspondent of the *Financial Times* states that the Commission appointed to study the question of rates for electricity has reported against any reductions even where the prices charged are disproportionate to the cost of production at to-day's currency value. It is known that the electric power companies lately have developed a considerable plant extension programme producing double the pre-war output. This plant has been installed on a lire exchange rate of 120 to 150 to the £, and in most cases on borrowed capital. The present Commission is composed of representatives of Government and municipal undertakings as well as of the electricity companies. Its report is unanimous and the decision is expected to react favourably on the financing of water-power enterprises in Italy, which otherwise would have found it difficult to secure at home or abroad the necessary funds to complete the extension of their existing plants.

BAVARIA.—According to a report recently issued by the State Statistical Office, there are now 11,928 large and small hydro-electric plants with a total capacity of 848,705 h.p. in operation in Bavaria, while thirteen new plants with a total of 91,000 h.p. are in course of construction. In 1926 the output of the water-driven plants amounted to 2,245 million kWh, or about 8.5 per cent. of the total output of Germany.

LATVIA.—Acting on the recommendations of the chief engineer of the city power station, a special commission has been appointed by the municipal authorities of Riga, to draw up preliminary specifications for a new power plant.

Dundee.—LOAN SANCTIONED.—The Corporation has received sanction to a loan of £72,400 for electricity extensions.

Dutch East Indies.—CELEBES.—A Rotterdam concern is reported to have secured a concession to establish a power plant at Menado, Celebes.

Epsom.—LOAN.—The Urban District Council has applied for sanction to a loan of £2,000 for the purchase of electrical apparatus to be let out on hire.

Glasgow.—PROGRESS DURING NOVEMBER AND DECEMBER.—Under the Corporation Electricity Department scheme for the wiring of premises, 405 houses were wired during November, bringing the total to 5,951. Applications for hire of appliances numbered 693, making the total 17,596. In December, 318 houses were wired and the number of additional appliances let out on hire was 753.

Hastings.—NEW COOLING TOWER.—The Town Council has decided to rebuild the water-cooling tower at the power station at a cost of £7,150.

Kendal.—ELECTRICITY SUPPLY.—Negotiations are proceeding between the Town Council and Barrow-in-Furness Corporation with a view to the possibility of the latter authority's electricity service outside the borough being extended to Kendal.

Keighley.—NEW PLANT.—The Town Council, on January 17th, authorised application for sanction to install additional generating plant to cost about £75,000, and to comprise a 10,000-kW set, with boilers for evaporating about 40,000 lb. of steam per hour, to be erected on the site of the present fire brigade station (adjoining the present power station). There has been increased demand both for domestic consumption and for power for textile machinery. The Electricity Committee states that it is impossible to link up with Bradford at present, and although it is expected that the local station will close down eventually, the Committee contemplates being allowed to continue generation in Keighley for some years as a secondary station, and that the capital cost of the plant will be paid off before closing down.

Kirriemuir.—ELECTRICITY SUPPLY.—The Town Council has been informed by the Grampian Electric Supply Co. that it expects to be able to provide a supply of electricity in Kirriemuir during the winter of 1928-29.

Kirk Sandall.—STREET LIGHTING DISPUTE.—According to the *Manchester Guardian*, the electricity supply of the village, which has a population of 5,000, has been cut off by Messrs. Pilkington Brothers in consequence of a dispute with the local authorities. When the company established its branch works there eight years ago, it built a model village, which for six years it has provided with free electric street lighting, understanding that the Doncaster Rural District Council, in accordance with powers it possesses, would levy rates and repay the firm. The Council declines to move in the matter, however, until the Kirk Sandall Parish Council approves. The Parish Council declares that the lighting is unnecessary and expensive. Messrs. Pilkington reply that the cost would be 2s. 2d. per head per annum to the average ratepayer, and in order to compel the local authorities to act they have cut off the supply for an indefinite period.

Lincolnshire.—CONFERENCE OF LOCAL AUTHORITIES.—According to the *Yorkshire Post*, the question of the electrification of Lincolnshire was considered at a conference, held *in camera*, at the Lindsey County Council offices, Lincoln, on January 18th, of representatives of the Lindsey and Kesteven County Councils, and practically all the urban and rural councils in the county. The position is that the Lincolnshire Power Company is applying for powers to supply electricity throughout Lincolnshire, except where there are existing local authorities or bodies authorised to supply it; and Mr. Borlase Matthews, of the Public Utility Service Company, is proposing to apply for a Special Order authorising him to do the same thing. The question before the conference was which of these rival schemes should have their support. Neither the Lincolnshire Power Company nor Mr. Matthews's

company was represented at the conference, and the meeting was not in a position at the moment to decide upon the merits of the respective schemes. The question whether electricity should in the future be supplied by the local authorities themselves or by an outside company such as those which were putting forward schemes at the present time was considered, but no decision on the point was arrived at, and the matter will receive further consideration in due course. The time for petitioning against the Bill of the Lincolnshire Power Company expires on February 18th, and the conference decided to present petitions against this Bill, in order to preserve the freedom of the County Council to criticise both schemes when it has them before it. It was also decided to recommend local authorities to empower representatives to act for them at any future conference.

London.—STEPNEY.—The Electricity Supply Committee has recommended to the Borough Council that application be made for sanction to the installation of a further 100,000-lb. boiler at Limehouse power station.

ST. MARYLEBONE.—The Borough Council has received sanction to a loan of £27,209 for electricity purposes.

North Berwick.—STATION CLOSED DOWN.—The Town Council's oil-engine power station was closed down on January 20th, and a supply is now obtained from the Portobello power station through the Lothians Electric Power Co.

North Wales.—HYDRO-ELECTRIC SCHEME.—The dam which the North Wales Power Co. is constructing at Maentwrog Uchaf, in Merionethshire, has been nearly completed. The scheme provides for a new hydro-electric station, from which electricity will be distributed throughout North Wales, the transmission lines extending as far as Crewe, where a connection will be made with the South Cheshire Electricity District.

Preston.—ELECTRICITY CHARGES.—We have received from the borough electrical engineer (Mr. J. F. Simpson) the following scale of electricity charges now in operation in the Council's area of electricity supply:—Lighting: Within the borough, 6½d. per kWh; other districts, 7d. per kWh. Alternative rates of £12 per kW of the installed demand, plus 2d. per kWh or £12 per kWh of maximum demand, plus 3d. per kWh, is offered to business premises. Heating, cooking, and domestic purposes: First 250 kWh per quarter, 1½d. per kWh; next 250 kWh, 1¼d.; over 500 kWh, 1d. per kWh. The "electric home" system: A fixed charge of 20 per cent. per annum on the net rateable value of a house up to £40, and 5 per cent. on the amount of the assessment over £40, with a minimum charge of £3 per annum, plus 1d. per kWh for electricity consumed. Power for industrial purposes: Varying from 2¼d. per kWh for 1,000 kWh per quarter to 0.9d. for 187,500 kWh, with an alternative tariff for "long-hour" users of £1 5s. per quarter per kW of maximum demand, plus 0.5d. per kWh. All the above charges are subject to discounts, according to the class of supply, for prompt payment of accounts.

LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £26,300 for extensions at Ribble power station.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

WATFORD.—Power and heating: A further 5 per cent. rebate, with 2½ per cent. discount for prompt payment of accounts.

HARWICH.—The additional charge of 12½ per cent. has been abolished and the power charge reduced from 2d. to 1½d. per kWh.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Bourne Urban District Council authorising it to supply electricity in its area; the Salisbury Electric Light & Supply Co., Ltd., to extend its area of electricity supply so as to include those parts of the city of Salisbury which were added to the city by the New Sarum (Extension) Order, 1927, and parts of the rural district of Salisbury; the West Lancashire Rural District Council to supply in the parish of Aughton; and the Cullompton Electric Supply Co., Ltd., to supply electricity in certain parishes in the rural districts of Culmstock, St. Thomas, and Tiverton.

Staveley (Chesterfield).—ELECTRICITY SUPPLY.—The Staveley Coal and Iron Co., Ltd., has recently installed the third and final set of Grant gas engines. The company has now an annual output of 60,000,000 kWh. Co-operation with local authorities, firms and collieries has assisted the development scheme, and lines have been constructed to link up with the Derbyshire and Notts. Electrical Power Co., so as to co-ordinate the system of supply throughout an extensive area. The Staveley Co. at present provides a bulk supply to the Chesterfield Corporation, and for the public lighting of Staveley, Eckington, Birmingham, Clowne, Barlborough, Shirebrook, Poolsbrook, and Bolsover, and many collieries and works in Derbyshire.

Stone (Staffs.).—ELECTRICITY SCHEME.—At a recent meeting of the Urban District Council it was decided to proceed with the scheme for providing a supply of electricity to the town, and in the adjoining districts in the area of supply as laid down in the Special Order, which has recently been granted. An agreement with the Stoke Corporation for the supply of electricity in bulk has been approved. Mr. W. M. Selvey, consulting engineer, has been instructed to proceed with the general scheme.

Tramway and Railway Notes.

Bournemouth.—LOAN.—The Town Council has received from the Ministry of Transport sanction to a loan of £20,000 in connection with the contemplated abandonment of the Lower Parkstone tramway route.

Bradford.—PURCHASE OF TRACK.—Powers are being sought by the Corporation for the purchase of the tramway of the Halifax Corporation which extends from Bailiff Bridge to Brighouse, and to construct a new tramway for a short distance in connection therewith and also to facilitate through communication between the tramways of the two Corporations.

RAILLESS CARS.—The Corporation is applying for a Provisional Order to run railless cars in the district of Shipley.

Continental.—SPAIN.—Approval in principle has been given by the Cabinet to a scheme for the reform of the present railway system by the electrification of sections passing over mountain chains or carrying an exceptional amount of traffic—making in all a total of about 1,250 miles of track. The sections crossing the Sierra de Guadarrama and the Cantabrian and Iberian Mountains, as well as the Catalonian system, with its excessively heavy traffic, are included. The total cost of the scheme is estimated at £10,500,000. Water power derived from works already established on several rivers will be utilised. The intention is to push the work forward as quickly as possible and a committee of experts representing the State and the railway companies is to prepare plans at once.—*Reuter* (Madrid).

SWITZERLAND.—The electricity for the recently completed electrified section of the Swiss Federal Railways between Zurich, Richterswil, Sargans and Buchs, is being supplied from the outdoor transformer stations at Sihlbrugg and Sargans, the energy being received at a pressure of 66,000 V and stepped down to 15,000 V. To connect the Sargans station with the generating plant at Kublis, a new 66,000-V line 20 miles in length has been erected. For the 100 miles of railway between Lausanne, Biel, and Olten, the power is being supplied from three sub-stations at Bussigny, Biel, and Olten respectively.

East Midlands.—PROPOSED ABANDONMENT OF TRAMWAY.—According to the *Financial Times*, the Nottinghamshire and Derbyshire Tramway Co., which was incorporated in 1903, will introduce a Bill into Parliament next session for powers to substitute railless cars and omnibuses along the routes of its existing and authorised tramway system.

Glasgow.—PINKSTON STATION.—The Corporation Electricity Committee, in a statement issued to members, replies to the report of the tramways manager regarding the proposal to spend £237,000 on the reconditioning of the electrical plant at Pinkston power station. The Committee points out that the co-operation of the two departments under uniform control would bring about a saving in expenditure of £13,000 per annum, and in addition substantial economies in the operation and maintenance of the generating plant and sub-stations. The report contends that Dalmarnock power station is quite able to supply any extra demand of the tramway department, and that in the event of further capital expenditure being required for generating plant this ought to be carried out at Dalmarnock, which is a more efficient power station than Pinkston and has greater opportunities and facilities for extension. It is pointed out that the capacity of the last two units at Pinkston is 22,500 kW, and that these units are capable of carrying the fullest load the tramway system is ever likely to experience. The tramway department contends that if it were brought within the new electricity scheme it would have to pay higher prices for electricity, which would make it impossible to balance accounts. Regarding the expenditure of £237,000, it is pointed out that a large sum has been set aside in the tramway accounts for the renewal of plant, and the proposed expenditure would not entail any borrowing.

London.—BREAKDOWN.—One of the coaches of a train approaching the Latimer Road junction of the Metropolitan Railway, at 3.30 p.m. on January 19th, became derailed and blocked both lines. Trains from the city were cut off from Uxbridge Road and Addison Road stations on the branch line, and Wood Lane, Shepherd's Bush, Goldhawk Road, and Hammersmith stations on the main line. A normal service was in operation by 7 p.m.

TRAMCAR SPEEDS.—The speed of the London County Council tramcars has attained to an average of 9¾ miles an hour, including stops. This is the highest average speed of any urban tramways in the kingdom, according to an official of the London County Council. The London General omnibuses maintain an average speed of eight miles an hour, including stops.

Sudan.—INAUGURATION OF TRAMWAY.—According to the *Financial Times*, the Omdurman bridge and the Omdurman-Khartoum electric tramway service were formally inaugurated by the Governor-General on January 16th. The tramway, which is the first in the country, links up Omdurman with the Sudan railway system, and provides the first through connection between the two towns. The length of the route is three miles.

Telegraph and Telephone Notes.

Italy.—TRANSATLANTIC TELEGRAPHY.—The submarine telegraph cable of the Compagnia Italiana dei Vavi Telegrafici Sottomarini connecting Rome, Malaga, Las Palmas, St. Vincent, Rio de Janeiro, Montevideo, and Buenos Aires, which was opened on October 12th, 1925, has recently been augmented by two new sections—a Rome to Barcelona cable and a Barcelona to Malaga cable.

Palestine.—TELEGRAPH CABLE.—The laying of a new cable to link Palestine with the submarine telegraph system of the world has been completed, and will be opened to public traffic by the Eastern Telegraph Company shortly. The cable connects Larnaka (Cyprus) and Haifa, and is the first submarine cable to be laid to Palestine. The Eastern Associated group is now at work on underground lines between Port Said and Suez, in order to bring about direct communication with India. By means of the "regenerator," complete automatic working is made possible, and the need for re-transmission eliminated.

Philippines.—RADIO-TELEGRAPHY.—A wireless telegraph service between the Philippines and French Indo-China and the Kingdom of Siam was recently inaugurated by the Radio Corporation of the Philippines. Automatic transmission and reception gives direct communication between Manila and Saigon, says the *T. & T. Age*, while messages to Siam are sent *via* Saigon.

The Telephone Service.—CONCRETE MANHOLES.—During the last financial year, over 660,000 miles of telephone wire were installed under the supervision of the British G.P.O., and the requisite manholes and jointing chambers were made of reinforced concrete. It has been found that by using reinforced concrete, manholes cost less than the brick structures of prewar days, despite increased labour and material charges.

Telephone Statistics.—WORLD'S FIGURES. — There were 29,274,000 telephones in use throughout the world on January 1st, 1927, the latest date for which complete world returns are available. North America claimed 19,118,000, Europe 7,993,000. Asia 963,500, Australasia 578,500, South America 432,500, and Africa 188,500. Europe during the year added only 518,000 new installations, against 610,000 in the previous year, the falling off being chiefly due to the fact that Germany's increase was only 100,000, half that of the previous twelve months.

Transatlantic Telephony.—BELGIUM.—The United States Ambassador and M. Lippens, Minister of Railways and Communication, on January 19th opened a wireless telephone service between Belgium and the United States. The experiment was highly successful, voices from America being heard with great clarity. The British and Belgian engineers who have carried out the work were warmly congratulated on the remarkable results achieved.—*Reuter* (Brussels).

Communication was established *via* the Anglo-Continental cross-Channel submarine telephone cables and the British radio stations at Rugby and Cupar.

Radio Notes.

Canada.—NEW STATION.—Mr. Bracken, the Premier, states that the Manitoba Government will erect at Brandon a radio broadcasting station which will be the most powerful and up-to-date in Canada. The equipment for it will be ready in about six months.—*Reuter* (Brandon, Manitoba).

Czecho-Slovakia.—LICENCES.—The number of wireless subscribers at the end of last year exceeded 200,000. In 1925 the number increased to 18,000, says *World-Radio*, and towards the end of 1926 the number reached 128,000. During 1927 the total passed 150,000.

International Broadcasting.—LONG-DISTANCE RELAYS.—The British Broadcasting Corporation is to develop simultaneous broadcasting from several stations of a single programme and transmission to the Empire by arranging for the retransmission in this country of items originating in foreign stations, and therefore is to establish land-line contact between a number of foreign stations and 2LO; the Vienna-Thanet cable has proved a satisfactory medium. It is understood that immediate co-operation is forthcoming abroad, and that the Union Internationale de Radiophonie has long fostered the idea of an exchange of programmes between different countries.

United States.—SHORT-WAVE BROADCASTING.—The Federal Radio Commission opened its hearings on January 17th on the need for long-distance broadcasting and telegraph transmission on short waves. Representatives of newspapers, Press associations, telegraph companies, and the Government Department of Industries were present to claim short-wave allocations, says the *Daily Telegraph*. Mr. Mackay, representative of the communication system, said it was desired during the next five years to establish short-wave point-to-point radio circuits between New York, Chicago, San Francisco, Galveston, and elsewhere, co-ordinating with the present wires. The *New York Times* attorney said his newspaper desired to establish a station for Washington and the Pacific coast.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—BUENOS AIRES.—March 15th. Ministry of Public Works. 24 cranes (steam, Diesel, and electric). (A.X. 5741.)*

Australia.—MELBOURNE.—February 22nd. Victorian Railways. Electric butt-welding machine. (B.X. 4095.)*

February 15th. Drum sander, three-drum type, with electric motor and accessories. (A.X. 5722.)*

March 13th. Postmaster-General's Department. Motor generators. (B.X. 4136.)*

March 20th. Telephone receivers and parts. (B.X. 4135.)

April 17th. Harbour Trust. Two 3-ton and two 5-ton semi-portal electric cargo cranes. (A.X. 5827.)*

Barnes.—February 14th. Electricity Department. Rotary or motor convertors with h. and l.p. switchgear. (January 13th.)

Bristol.—January 30th. Port of Bristol Authority. Sixteen 2-ton electric capstans for the Royal Edward Dock, Avonmouth. Specification from the General Manager and Secretary, Docks Office, 19, Queen Square, Bristol.

Cheadle.—January 27th. Cheadle and Gatley Urban District Council Electricity Department. Annual contracts for electric lamps, meters, cable protection boards, service cable, and joint-box compound. Specifications from Mr. R. W. Willis, engineer and manager, 37, High Street, Cheadle.

Darlington.—February 13th. Electricity Department. One water-tube boiler, with mechanical stoker, economiser, air heater, chimney, &c. (See this issue.)

Dundee.—February 16th. Electricity Department. One 100-kVA indoor type sub-station transformer, 3-core e.h.p. and 4-core l.p. cable. (See this issue.)

Edinburgh.—February 27th. Electricity Supply Department. Four steam-generating units complete with mechanical stokers, economisers, air heaters, grit arrestors, chimneys, &c.; steam, water and dust extraction pipework and valves; one electrically-driven and two steam-driven boiler feed pumps. (January 20th.)

Egypt.—CAIRO.—January 31st. Egyptian State Railways, Telegraphs and Telephones, Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster. S.W.1. Supply of 1,750 vacuum metallic-filament lamps and 3,560 gasfilled lamps.

Greetland (near Halifax).—February 10th. Electric lighting installation at the Council school. Specification from Mr. P. H. Swire, Education Offices, Huddersfield Road, Elland.

Horsham.—February 4th. Electricity Department. One vertical Diesel oil engine (air injection type), direct coupled to a 625-kVA alternator, and one 500-kW rotary convertor, with switchgear, pumps, and auxiliaries. (January 20th.)

Hull.—February 13th. Tramways Committee. General stores for 12 months, including lamps, cable, switches, overhead equipment material, &c. General manager, Tramway Offices, Albion Street.

Kirkcaldy.—February 1st. Electricity Department. Substitution of a.c. for d.c. plant, and wiring. (January 13th.)

District Committee. Electric lighting of two-storey cottage-type houses. Schedules from Mr. Geo. B. Deas, architect, Central Chambers, Kirkcaldy.

Leeds.—February 17th. Electricity Committee. Twelve months' supply of stores, including cables, jointing, and insulating materials, &c. (See this issue.)

Leslie (Fifeshire).—February 6th. Town Council. Electric lighting installation for 40 houses. Specifications from Walker & Pride, architects, Church Street, St. Andrews.

London.—LONDON COUNTY COUNCIL.—January 30th. 3,700 tons of standard track rails, bolts and nuts, 800 tons of conductor rails. Chief Engineer, Old County Hall, Spring Gardens, S.W.1.

Steam feed, &c. Pipework and steam turbine driven pump for the Greenwich power station. (See this issue.)

CENTRAL ELECTRICITY BOARD.—March 6th. 132-kV switchgear for outdoor transforming stations. (January 20th.)

ISLINGTON.—February 1st. Electricity Department. Cooling towers, with valves, ponds, fans, motors, &c. (See this issue.)

Manchester.—February 6th. Electricity Committee. 250-, 500-, and 750-kVA static transformers. (See this issue.)

Nantwich.—February 23rd. Board of Guardians. Electric lighting installation for the Institution. Mr. G. P. Dennis, 66, South John Street, Liverpool. (Returnable deposit of £1 1s.)

New Zealand.—WELLINGTON.—Public Works Department. January 24th. Induction voltage regulators for Waikaremoana. (B.X. 4116.)*

March 27th. 11,000-V metal-clad switchgear for the Lake Coleridge scheme.(B.X. 4119.)*

March 21st. Post and Telegraph Department. Automatic telephone receivers. (B.X. 4143.)

May 25th. New Zealand Government Railways. Machine tools and workshop equipment. (A.X. 5823.)*

DUNEDIN.—February 29th. Electric Light and Power Department. 3,000-kW hydraulic turbine, generator and switchgear. (B.X. 4120.)*

Nottingham.—February 4th. Electricity Department. Exhaust, water and other pipework, valves, tanks, &c. (January 13th.)

Oldham. — February 18th. Electricity Department. Steam, feed, exhaust, drain and condenser water pipes, boiler-feed pumps, feed and drain tanks, &c. (January 20th.)

Ossett.—January 31st. West Riding Education Committee. Electric lighting installation for the grammar school. Specifications from Education Department, County Hall, Wakefield.

Plymouth.—February 20th. Electricity Department. Electricity meters, cables, transformers, and sub-station switchgear. (See this issue.)

Portuguese East Africa.—LOURENCO MARQUES.—March 26th. Port and Railways Department. Two groups of motor pumps for Ressano Garcia water supply. (A.X. 5831.)*

Salford.—February 4th. Public Health Committee. Re-wiring of Nos. 139-145, Regent Road. Specifications from Medical Officer of Health, 143, Regent Road.

South Africa.—CAPE TOWN.—February 16th. Electricity Department. 11,000-V and 600-V cables. (B.X. 4146.)*

JOHANNESBURG.—February 16th. Town Council. Metal filament traction lamps. (B.X. 4160.)*

Stafford.—February 1st. Education Committee. Remodelling of the electric light and power installation at the County Technical College, Wednesbury, and installation of electric lighting and power in the College extension. (January 13th.)

Stoke-on-Trent.—February 8th. Electricity Department. 12 months' supply of mains and cables; a.c. and d.c. meters; sub-station switchgear; static transformers. (See this issue.)

Swindon.—February 11th. Electricity Department. Telpher coal conveying plant, &c. (January 20th.)

Waterford.—February 18th Electricity Supply Department. Three 120-kVA transformers. five 60-kVA ditto. (January 20th.)

York.—February 8th. Electricity Department. H. and l.p. paper-insulated cables. (January 20th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aylesbury.—Town Council. Accepted:—
Transformer kiosk at Manor Park.—Lucy & Co.
Transformer.—Swedish General Electric, Ltd.

Bedford.—Electricity Committee. Recommended:—
Revolving band screen for circulating water (£544).—Ledward & Beckett.

Birmingham.—Tramways Committee.
Fifty improved-type double-deck tramcar bodies, with transverse seating.—Brush Electrical Engineering Co., Ltd.

Glasgow.—Electricity Committee. Recommended:—
Four 400-kVA transformers (£1,280). — Metropolitan-Vickers Electrical Co., Ltd.

Housing Committee. Recommended:—
Electrical installation at Low Balornock housing scheme (£1,969).—R. J. M'Intyre.

Government Contracts.—The following contracts were placed by various Government departments during December:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Dry batteries.—Ever-Ready Co. (Gt. Britain), Ltd.
Batteries.—Batteries, Ltd.
Relay and indicator lamp boxes.—W. H. Allen, Son and Co., Ltd.
Electric cable.—St. Helens Cable and Rubber Co., Ltd.
Cable installation.—G. E. Taylor & Co.
Cells.—Fuller Accumulator Co. (1926), Ltd.; London Battery and Cable Co., Ltd.; General Electric Co., Ltd.
Electric wharf crane.—T. Broadbent & Sons, Ltd.
Fan spares.—General Electric Co., Ltd.; Veritys, Ltd.
Telemotor operating gear.—McTaggart, Scott & Co., Ltd.
Telemotor-operated hoists.—McTaggart, Scott & Co., Ltd.
Electric light and lightning conductor installations.—G. E. Taylor & Co.
Electric lamps.—Siemens Electric Lamps and Supplies, Ltd.; Metro-Vick Supplies, Ltd.; British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Micanite.—Mica Products; Mica Mfg. Co., Ltd.
Motor-generator set.—Electric Construction Co., Ltd.
Adhesive insulating tape.—Ioco Rubber & Waterproofing Co., Ltd.
Electric trucks.—Electromobile, Ltd.

WAR OFFICE.

Copper sheet.—British Insulated Cables, Ltd.

AIR MINISTRY.

Underground cables (Filton).—Malcolm & Allen, Ltd.
Automatic starters.—Watford Electric & Mfg. Co., Ltd.

POST OFFICE.

Batteries (Liverpool Bank and Central Telephone Exchange).—Tudor Accumulator Co., Ltd.
Manufacture, supply, drawing in and jointing cable (Canterbury - Dover - Folkestone). — Pirelli-General Cable Works, Ltd.
Electric passenger lift (Maida Vale Telephone Exchange).—Keighley Electrical Engineering Co.
Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Sterling Telephone and Electric Co., Ltd.
Protective apparatus.—General Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.
Wireless apparatus.—General Electric Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.; Standard Telephones and Cables, Ltd.
Battery stores.—Hart Accumulator Co., Ltd.; Premier Accumulator Co. (1921), Ltd.
Cable (various).—Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.
Joint-box castings.—General Foundry and Engineering Co., Ltd.; Jones & Attwood, Ltd.; McDowall, Steven and Co., Ltd.; United Steel Cos., Ltd.
Conduits and fittings.—H. Incledon & Co., Ltd.; Perfecta Seamless Steel Tube and Conduit Co. (1923), Ltd.; Stella Conduit Co., Ltd.
Cords for telephones.—L.P.S. Electrical Co., Ltd.; Reliance Electrical Wire Co.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe and Fire Brick Co., Ltd.; Doulton & Co., Ltd.; Ensor and Co., Ltd.; Hepworth Iron Co., Ltd.; G. Jennings; H. R. Mansfield, Ltd.; J. Oakes & Co. (Riddings Collieries); Oates & Green, Ltd.; J. Place and Sons, Ltd.; Robinson & Dowler, Ltd.; Standard Brick and Terra Cotta Co., Ltd.; Stanley Bros., Ltd.; Sutton & Co. (Overseal), Ltd.; Sykes & Son; J. H. Turner & Lidney.
Telegraphic iron work.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.
Insulators.—Bullers, Ltd.
Odometers.—H. Miller & Co.
Tungar rectifiers.—British Thomson-Houston Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated Cables, Ltd.; Elliotts Metal Co., Ltd.; R. Johnson and Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated with the London Electric Wire Co. & Smiths, Ltd.
Insulated bronze wire.—Siemens Bros. & Co., Ltd.
Cadmium copper wire.—T. Bolton & Sons, Ltd.; R. Johnson & Nephew, Ltd.; F. Smith & Co., incorporated with the London Electric Wire Co. & Smiths, Ltd.

Enamelled copper wire.—British Insulated Cables, Ltd.
Flameproof wire.—W. T. Henley's Telegraph Works Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Battery materials.—India Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Le Carbone; Siemens Bros. and Co., Ltd.
Cable.—Liverpool Electric Cable Co., Ltd.
Condensing plant.—Worthington-Simpson, Ltd.
Porcelain insulators.—Taylor, Tunnicliff & Co., Ltd.
Static transformers.—Metropolitan-Vickers Electrical Export Co., Ltd.
Telegraph line material.—Bullers, Ltd.
Telephone switchboards.—Ericsson Telephones, Ltd.
Train-lighting equipment.—J. Stone & Co., Ltd.
Wire.—British Insulated Cables, Ltd.; Elliotts Metal Co., Ltd.; F. Smith & Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

Irish Free State.—DUBLIN.—Borough Commissioners.
Single- and 3-phase air-cooled transformers, all sizes, for the year.—British Electric Transformer Co., Ltd.
Three-phase oil-cooled transformers.—Bruce Peebles & Co., Ltd.
Three-phase oil-immersed transformers.—British Electric Transformer Co., Ltd.
Fourteen tenders were received.
—*Irish Builder and Electrician.*

LIMERICK.—Electric Lighting Committee. Accepted:—
New battery at power station (£3,250).—Tudor Accumulator Co., Ltd.

London.—HACKNEY.—Finance Committee. Accepted:—
Two 5,000-kW 3-phase transformers for the bulk supply to Stoke Newington (£3,655).—Bruce Peebles & Co., Ltd.
Switchgear (£1,950).—A. Reyrolle & Co., Ltd.

LONDON COUNTY COUNCIL.—Highways Committee.
Conveyor tables, elevators and gravity chutes for the Ticket-checking Department of the Council's tramways (£2,972).—Geo. Robson & Co., Sheffield (push-button control "stop" only).

METROPOLITAN WATER BOARD.—Accepted:—
Electric lamps.—Nelson Electric Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
Electrical fittings for new promenade at Muizenberg (£475); induction voltage regulators (£6,760).—South African General Electric Co., Ltd.
Five 500- and seven 300-kVA transformers (Ferranti) (£9,088).—A. Vaux, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
45 tons of rails for the extension of the pier tramway (£369).—T. W. Ward & Co.

Sunderland.—River Wear Commissioners. Accepted:—
Four 5-ton electric cranes.—Babcock & Wilcox, Ltd.

Forthcoming Events.

Institution of Production Engineers.—Friday, January 27th. 83, Pall Mall, S.W. 7.45 p.m. Annual general meeting.

Physical Society.—Friday, January 27th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, January 27th. 39, Victoria Street, S.W. 7.30 p.m. "Powdered Fuel for Boiler Firing." Mr. R. H. Allen.
Friday, February 3rd. 7.30 p.m. "Automatic Sub-Stations." Mr. D. Kingsbury.

Institution of Electrical Engineers.—Thursday, February 2nd. Institution, London, W.C. 6 p.m. "Some Practical Considerations in the Design of Automatic Equipments for Heavy Traction Sub-stations." Mr. H. B. Poynder.

(Wireless Section).—Wednesday, February 1st. Institution, London, W.C. 6 p.m. "The Design and Distribution of Wireless Broadcasting Stations for a National Service." Capt. P. P. Eckersley.

(North-Eastern Centre).—Wednesday, February 1st. Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. 7 p.m. Faraday Lecture, "Electricity in the Service of Man." Dr. S. Z. de Ferranti, F.R.S.

(Tees-side Sub-Centre).—Wednesday, February 1st. Cleveland Technical Institute, Middlesbrough. 7 p.m. "The Decorative Value of Electric Light." Mr. G. S. Evans.

(North-Western Students' Section).—Tuesday, January 31st. Milton Hall, Manchester. 7 p.m. "Control Equipment for d.c. Trains." Mr. J. W. Gibson.

Poplar Industrial Heating Exhibition.—Monday, January 30th to Saturday, February 4th. Electricity Works, Glaucus Street, Bromley-by-Bow, E.

Batti-Wallahs' Society.—Tuesday, January 31st. St. Ermins Hotel, S.W.1. 7 p.m. Informal evening.

Royal Institution of Great Britain.—Thursday, February 2nd. 21, Albemarle Street, W.1. 5.15 p.m. "From Faraday's Note Books." Sir Wm. Bragg, F.R.S.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, February 4th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Polyphase Motors and Control Systems." Mr. H. T. Gregory.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

EASY washer, with dryer (American made, name of British agent wanted).
OMEGA hair dryers, curlers, &c.

Notes.

Transatlantic Television.

Mr. L. G. Hutchinson, managing director of the Baird Television Development Company, who sailed from Southampton for New York on January 18th, is reported to have stated that television had been definitely established between England and America after secret experiments. They had worked from Leeds, Glasgow, Hull, and other places, and had been able faithfully to represent images in London, but the experiments with New York had been carried out with secrecy, and recently they had established contact with New York on several occasions. It was possible to see faces and hands, says *The Times*, although the features were indistinct. He was going to the United States to carry out official experiments in Transatlantic vision and to explore the prospects of establishing the system on a commercial basis.

Cables Laid in Bitumen.

The following statement has been issued by the Electricity Commission:—

The Electricity Commissioners are at present engaged in reviewing their existing Codes of Regulations for securing the safety of the public with the object of effecting a revision thereof, and in this connection have given special consideration to the possible consequences of the failure of cables insulated with bitumen and laid in wood casings, especially in the case of direct-current systems.

In June last the Commissioners caused an inquiry to be held on their behalf by Mr. G. Scott Ram, M.I.E.E., and Dr. J. S. Haldane, F.R.S., into the matter of an explosion which occurred at Acton with resultant loss of life and destruction of property. The report of the Inspectors, which was subsequently published, stated *inter alia*:—

"It appears to us that the method of laying service cables in pipes connecting with the houses, even if the pipes are initially stopped with clay plugs, is undesirable as offering a vent into the house for any gas which might accumulate in the soil from any cause such as the fracture of a gas main.

"We further think that the practice of not giving the station attendant discretion in the matter of switching-off in the case of a heavy fault in a bitumen main pending instructions from the mains department, the members of which may not be immediately available, especially, as in this case, at night when they were in bed, is not satisfactory. If the attendant in this case had been permitted to disconnect the feeder in the early stages of the short circuit, there would probably have been no explosion."

The views expressed by the Inspectors have been carefully considered by the Commissioners, and pending a decision as to the amendment of the existing Regulations, the Commissioners consider it desirable to acquaint authorised undertakers with their broad conclusions in respect of the abovementioned matters, namely:—

(*a*) That all services into consumers' premises should either be laid solid or taken into the premises in such other manner as to prevent any influx of gas at the point of entry; and

(*b*) That there should be a frequent and regular testing of cables laid in bitumen, and also inspection where accessible, particularly in the case of cables which carry direct current and have been in use for a number of years.

In the opinion of the Commissioners it is also advisable, notwithstanding the importance of continuity of supply, that station and sub-station attendants should be given reasonable discretion in the matter of switching-off circuits in the case of a heavy fault where cables laid in bitumen are known to be involved.

Large High-pressure Boilers.

Considerable interest is attached to the boiler plant which is at present being constructed in this country by International Combustion, Ltd., for Synthetic Ammonia and Nitrates, Ltd., in that it is claimed that it will be the largest high-pressure boiler plant to be installed in the world as an industrial unit. The equipment is to be constructed on the "Lopulco" system of pulverised-fuel firing. The working pressure will be 800 lb. per sq. in., and, with the exception of that of the 1,300-lb. Milwaukee (U.S.A.) boiler, will be the highest yet employed. The new plant, which will consist of six boilers, will have a normal evaporation capacity of 269,000 lb. per hour, and the final temperature of the steam will be 840 deg. F. The design of the firing equipment is on the bin and feeder principle, and the makers' new "R" burner will be embodied. The coal-handling equipment will have a capacity of 3,800 tons per day. An important innovation in connection with the boilers is that they will be entirely rivetless and seamless. They will also be of the vertical-tube type.

The Overhead Lines Association.

The next meeting of the Association, which will be held at the Institution of Electrical Engineers on February 8th, will be devoted to a discussion on proposed amendments to the Regulations for Overhead Lines.

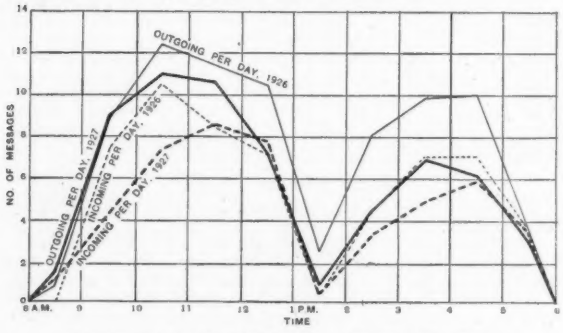
Automatic Telephony in London.

Messrs. Marryat & Place, the old-established London electrical engineers and contractors, have sent us copies of a letter and diagram (reproduced below) which they have sent to the controller of the London Telephone Service; the documents are self-explanatory, and the matter is referred to editorially in this issue:—

January 18th, 1928.

"Dear Sir, COPY.

"We have written several times making complaints about the very serious loss which we are now subjected to owing to the introduction of the automatic telephone in the Holborn exchange. So far we have received no redress and no intimation of what you propose to do to assist us.



Curves Indicating Telephone Traffic Decline.

"We enclose you herewith a diagram showing the falling off in the number of calls which we receive and which we are able to send out at every hour of the day, comparing December, 1927, and December, 1926.

"This loss has occurred despite the fact that the business has otherwise increased very greatly. We have daily information that our customers are unable to get through to us, and consequently they call in other contractors to do their work.

"The thing has now become so serious that we must ask you to please intimate to us what steps we are to take ourselves, or you can take for us, to enable our customers to get in touch with us from hour to hour during the day as they require our services.

"If you will send a representative here to see our Mr. Marryat he will indicate to you from a chart we have in the office the nature of our business and the absolute necessity for telephone communication with our clients.

"Yours faithfully,

"MARRYAT & PLACE,

"H.M."

Tidal Power at Exmouth.

The question of obtaining electrical power from the tidal waters of the Exe Estuary was discussed at Exmouth, Devon, on January 19th, at a conference initiated by the Exe Power Experimental Association, a private concern, and attended by representatives of local authorities in Devon affected or interested. It was stated that funds were required for a further experiment. Two pence per kWh was suggested as the basis of the first experiment, which had been carried out on a small scale. The maintenance of supply during low tides was considered and storage batteries were suggested as a solution. It was agreed that local authorities had no power to spend the ratepayers' money on this enterprise. No resolution or definite proposal was submitted, but it was understood that the representatives would discuss the situation with their respective bodies.

Beam Engines.

With regard to the note on p. 57 of our issue of January 13th, Mr. Edgar Loam, M.I.E.E., writes: "Two 80-in. cylinder Cornish pumping engines designed and erected by my grandfather in 1875 at the Hodbarrow mines in Cumberland were working last year, though the auxiliary plant had been electrified. Also the "Cornish man engine"—invented and erected at the Levant mine in Cornwall in 1845 by my great-grandfather—finally broke down in 1920. It was also worked by a beam engine. One of these engines was working at Dolcoath mine during the war."

Appointments Vacant.

Shift engineer (£344) for the Lancashire Electric Power Co. Plumber-jointer for the Borough of Kendal Electricity Department. Overseer and two foremen for the Dublin Posts and Telegraphs Factory. (See our advertisement pages to-day.)

Employés' Representation on West Midlands J.E.A.

The Minister of Labour gives notice that as soon as possible after February 6th he will designate to the West Midlands Joint Electricity Authority the employés' organisations having members in the employment of authorised undertakers in the district, in order that these organisations may choose a representative to be a member of the Joint Authority. Any employés' organisation which is desirous of being considered by the Minister for designation should apply to the Secretary, Ministry of Labour, Montagu House, Whitehall, S.W.1, not later than February 4th.

E.A.W. Activities.

The Glasgow and District Branch of the Electrical Association for Women held a successful whist drive in the Ca'doro Restaurant, Glasgow, on January 16th, when Mrs. R. B. Mitchell (wife of the engineer and manager of the Glasgow Corporation Electricity Department) presided. Mrs. Mitchell stated that 86 new members had been enrolled in the branch, bringing the membership up to a total of nearly 500.

On January 20th students from the Chelsea Polytechnic visited the new all-electric kitchen of the Association at 46, Kensington Court, W.8, where they were given a practical demonstration by a member of the staff on the use, maintenance, and cost of domestic electrical apparatus.

Two new branches of the Association are to be formed at Ashford (Kent), on January 25th, and at Leeds, on January 27th. Lady Kathleen Pilkington will be the president of the Leeds and West Riding Branch.

Fatality.

Wilfred Ernest Chapman, the 13-year-old son of a Bentley, Doncaster, colliery deputy, received a fatal electric shock when, while playing, he threw a wire over an overhead electric power cable.

Association of Consulting Engineers (Incorporated).

On Monday last the annual dinner of the Association was held at St. Stephen's Club, Westminster; Mr. S. B. DONKIN, M.Inst.C.E., chairman of the Committee, presided, and there were present about 150 members and guests.

Mr. L. ST. L. PENDRED proposed "The Engineering Industry" in a humorous speech, in the course of which he advocated closer relations between the Home country and the Dominions. Col. R. K MORCOM, C.B.E., responding, referred to the prevailing industrial depression, but little relieved by the comparative activity of the electrical industry; he said there was little return on capital in the heavy engineering industries, and those who encouraged insane competition were courting disaster. He invited the members of the Association to co-operate with the manufacturers in providing security of employment and decent wages for the workmen: it was better to pay a fair price to British labour than to save a few thousands by buying abroad.

Mr. J. SWINBURNE, F.R.S., proposing "Engineering Institutions," urged that engineers should not confine their attention to engineering work, but should take an active part in public affairs. Most of our troubles were due to misgovernment by ignorant and foolish people; an engineer was necessarily logical—let them create an atmosphere of common sense. Mr. E. C. TRENCH, C.B.E., president of the Institution of Civil Engineers, and Sir HENRY FOWLER, K.B.E., president of the Institution of Mechanical Engineers, responded to the toast.

Mr. H. J. DEANE, M.Inst.C.E., proposed "Bench and Bar," and the Hon. Mr. Justice MCCARDIE, in response, suggested that our system of government was not a democracy, but an "oratocracy," which would never build a great empire. The Right Hon. H. P. MACMILLAN, K.C., also responded, testifying to the honesty and integrity of the expert witness.

The toast of "The Association of Consulting Engineers" was proposed by Sir HARRY HAWARD, vice-chairman of the Electricity Commission, who maintained that the Association stood for independence and maintained a high standard of professional etiquette. They must be prepared for great changes, when their services might not be so necessary in this country—but there would still be many engineering problems to solve, both at Home and in the Dominions. The CHAIRMAN, in responding, expressed the indebtedness of the Association to the honorary officers, especially the hon. secretary, Mr. A. H. Dykes.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Events in China have operated unfortunately in the experience of a number of British electrical and other engineers. One case in particular that we may mention is that of Mr. DOUGLAS O. BATES, A.M.I.E.E., late electrical engineer to the Chinese Government Railways, Peking-Mukden Line, Tongshan. He joined that service in 1911, and was responsible for the electric light and power equipment of the main shops of the railway at Tongshan. He also installed lighting plants at various stations along the line, equipped the coaching stock with Stone's system of train lighting, and trained an electrical staff to a high state of efficiency. He has now had to leave his work behind him owing to the long period of civil war having depleted the financial resources of the various authorities. The strain fell so heavily upon the Chinese Government Railways in North China that a commission was appointed to investigate the position, to see what reductions in staff and other economies could be effected, and one of the results of the inquiry was dispensing with the services of Mr. Bates. There was also a desire to replace as far as possible non-Chinese employés by natives We have seen a communication by H.B.M. Consul at Tientsin testifying to the above facts, and stating that the unfortunate upshot conveys no reflection on the services rendered by Mr. Bates. The present address of the latter gentleman, who hopes to go abroad in the near future, when an opportunity occurs, is the "Bell Hotel," Dorking, Surrey.

Dr. JOSEPH RAHER, of Kussnacht, Switzerland, has been appointed director of the International Bureau of the Telegraphic Union in Berne as from February 1st next.

The Electricity Committee of Leicester will recommend the Council at its meeting on January 31st to appoint Mr. JOHN MOULD, acting engineer and manager, to be manager of the undertaking in succession to Mr. T. R. Smith. It is proposed that his salary be advanced from £900 per annum to £1,500, the same as was received by Mr. Smith. Mr. Mould went to Leicester as chief assistant engineer nine years ago from Messrs. Siemens at Stafford.

Mr. H. POOL, assistant manager of the Leicester tramways undertaking, has been promoted to be general manager, Mr. A. E. LUCAS having resigned through ill-health.

Mr. HERBERT RAINFORD, A.M.I.E.E., who is engaged in research work on explosion-proof electrical apparatus at Sheffield University, has been married to Miss ANNIE WELLS at Clapham Common.

Our American contemporary, *Telephony*, announces that Mr. H. E. POWELL JONES, secretary of the Telephone Development Association, London, has been awarded the second prize in an open competition for the best article on telephone work.

The Tramways Committee of the Southampton Town Council has recommended that the salary of the tramways manager and engineer, Mr. P. J. BAKER, be increased from £900 to £1,000 per annum.

While motoring home to Musselburgh on Thursday night last week Mr. H. E. C. BABB, general manager to the Musselburgh and District Electric Light and Traction Co., struck a telephone post at a bend in the road and is suffering from concussion of the brain.

The Council of the Institution of Electrical Engineers has made the seventh award of the Faraday Medal to Prof. J. A. FLEMING, M.A., D.Sc., F.R.S., Honorary Member of the Institution.

The Radcliffe Urban Council has increased the salary of the electrical engineer, Mr. Wilkinson, from £600 to £700 per annum.

The board of Sir W. G. Armstrong, Whitworth & Co., Ltd., have appointed Lieut.-Col. W. T. C. HUFFAM, O.B.E., M.C., their chief representative and local director in India, Burma, and Ceylon, with offices in Bombay.

The following have been elected Members of Council of the Faraday House Old Students' Association: Mr. F. E. BERRY (president), Mr. R. W. BILES, Major C. H. FLOWER, M.C., Mr. A. REGNAULD, B.Sc., A.R.C.Sc., the Rt. Hon. the EARL OF ROTHES, and Mr. A. L. STOCK.

At the ordinary meeting of the Institution of Electrical Engineers to be held on Thursday, February 2nd, at 6 p.m., a portrait in oils of Mr. LL. B. ATKINSON, Past President, I.E.E., will be formally presented to the Institution by the Cable Makers' Association. This portrait was painted by G. Harcourt, R.A.

Obituary.—MR. A. MAUND.—The death took place on January 7th, at the age of 65 years, of Mr. Albert Maund, who was in business as an electrical engineer in Hoghton Street, Southport.

MR. MICHAEL LONGRIDGE.—We regret having to record the death of Mr. Michael Longridge, C.B.E., M.A., M.Inst.C.E., and a past president of the Institution of Mechanical Engineers. He passed away at Exeter on January 18th at the age of 80 years. For several years from 1875 he was assistant engineer to the Boiler, Insurance and Steam Power Company, of which his uncle, the late Mr. R. B. Longridge, was chief engineer and manager. He became chief engineer to the British Engine, Boiler and Electrical Insurance Company when it was formed in 1878. His annual reports on breakdowns of electrical machinery and apparatus were reproduced in lengthy abstract in the ELECTRICAL REVIEW for many years. He had been president of the Institution of Mechanical Engineers, and of the Manchester Association of Engineers, and was a member of the Engineering Standards Committee, and of the general board of the National Physical Laboratory.

MR. A. W. BAIRD.—We regret to note from the *Engineer* that Mr. Alfred W. Baird, a director of Kelvin, Bottomley and Baird, Ltd., of Glasgow, was accidentally drowned the week before last at Dundee. While being transferred from the new motor tanker *British Faith* to a tug, he slipped from the accommodation ladder into the water and no trace of him could be found. Our contemporary mentions that when quite a young man Mr. Baird was appointed to be a personal assistant to Sir William Thomson (Lord Kelvin) with whom he worked for over fifteen years. He was 65 years of age and had been with the company 40 years.

MR. J. H. C. HEWETT.—The death took place on January 7th of Mr. John Hewett, M.I.E.E., M.I.C.E., consulting engineer, of Staplegrove, Church Street, Hampton, Middlesex. He was 59 years of age. He joined the I.E.E. as an Associate in 1888 and became a full member in 1903.

MAJOR-GENERAL GOETHALS.—The death is reported at the age of 70 years of Major-General G. W. Goethals, chief engineer responsible for the construction of the Panama Canal.

Wills.—Sir REGINALD LOUIS OATES, Bart., general manager of the Cairo Electric Railways and Heliopolis Oasis Company, left property in this country valued at £13,272.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Dorking Electricity Supply Co., Ltd.—Registered as a "public" company on January 14th, with a nominal capital of £50,000 in £1 shares. The objects are to carry on the business of an electric light and power company in all its branches. An agreement has been entered into between the Urban District Council of Dorking and Edmundson's Electricity Corporation, Ltd., who are the promoters. £29,233 is to be paid to the promoters, which amount has been expended by them on capital account in respect of the Dorking Electric Lighting Corporation. The minimum cash subscription is seven shares. The directors are:—A. N. Rye, Woodland, Wellington Avenue, Virginia Water, electrical engineer; A. Anderson, 4, Conway Road, Wimbledon, S.W., engineer; and C. H. Jones, 67, Hayes Road, Bromley, chartered secretary. Registered office: Broad Sanctuary Chambers, Tothill Street, Westminster.

South Somerset and District Electricity Co., Ltd.—Registered January 14th, with a nominal capital of £20,000 in £1 shares. Objects: To carry on the business of an electric light and power company in all its branches, &c. The minimum cash subscription is seven shares. The subscribers (each with one share) are: W. H. Walford, 10, Lambourne Road, Leytonstone, E.11, solicitor's clerk; W. J. Yeoman, 244, Lordship Lane, East Dulwich, S.E.22, solicitor's clerk; and five others. The subscribers are to appoint the first directors. Qualification: £250 shares. Solicitors: Ashurst, Morris, Crisp and Co., 17, Throgmorton Avenue, E.C.2.

Drummond Heaters, Ltd.—Private company. Registered January 19th. Capital, £2,000 in 10s. shares. Objects: To adopt an agreement with D. G. F. Drummond, and to carry on the business of manufacturers of or dealers in heaters of all types and apparatus in connection therewith. The directors are W. D. Greenleaf, 71, Manor Park, Lee, S.E. (director of Douglas Taylor, Ltd., and J. W. Greenleaf, Ltd.); D. G. F. Drummond, Woodside, Marton, Yorks., electrical engineer. Qualification: £100 shares. Solicitors: Hedley & Thompson, 11, Park Terrace, Sunderland.

Eros Engineers, Ltd.—Private company. Registered January 19th. Capital, £4,000 in £1 shares. Objects: To acquire all or part of the assets and undertaking of Eros Engineers, Ltd. (incorporated in 1919, and now in voluntary liquidation), to assume all or any of the liabilities of the old company, to make such arrangements with its liquidator as the directors may think proper or expedient, to adopt an agreement with the old company and W. J. West, and to carry on the business of motor, electrical, gas, mechanical, and general engineers, &c. The subscribers (each with one share) are: M. E. Starkey, 13, St. Bartholomew Road, Nottingham, engineer; W. E. Clarke, 26, Arthur Street, Loughborough, engineer. The first directors (to number not fewer than two or more than five) are to be the board of directors (not named) of the old company. Solicitors: Acton, Marriott & Simpson, King Street, Nottingham.

Official Returns of Electrical Companies.

Silgolum, Ltd.—Issue on December 29th, 1927, of £150 debentures, part of a series already registered.

New Union Electric Co., Ltd.—Debenture dated January 4th, 1928, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. H. A. Kaye, Fox Farm, Sanderstead, Surrey.

Carter & Co. (Nelson), Ltd.—Capital, £5,000 in £1 shares. Return dated June 24th, 1927. 4,000 shares taken up. £4,000 paid. Mortgages and charges: £575.

City Electrical Appliances, Ltd.—Capital, £5,000 in £1 shares. Return dated June 28th, 1927. 2,157 shares taken up. £2,130 15s. paid. £26 5s. in arrears. Mortgages and charges, nil. Return of allotments, made up to August 31st, 1927, shows a further 30 ordinary shares allotted, payable in cash, and fully called up.

A. F. A. Accumulators, Ltd.—Capital, £5,000 in £1 shares. Return dated July 19th, 1927. All shares taken up. £1,251 paid, £3,749 considered as paid. Mortgages and charges, nil.

G. L. Adamson, Ltd.—Capital, £7,500 in £1 shares. Return dated July 14th, 1927. 5,100 shares taken up. £600 paid, £4,500 considered as paid. Mortgages and charges, nil.

Mevagissey Electric Supply Co., Ltd.—Capital, £5,000 in 4,433 preference shares of £1 each, and 1,134 ordinary shares of 10s. each. Return dated July 4th, 1927. All shares taken up. £336 15s. paid (being £1 per share on 280 preference and 2s. 6d. per share on 454 ordinary shares). £4,663 5s. considered as paid (being £1 per share on 4,153 preference, 7s. 6d. per share on 454 ordinary, and 10s. per share on 680 ordinary shares). Mortgages and charges: £1,898 5s.

Tetbury Electric Supply Co., Ltd.—Capital, £6,000 in 600 preference shares of £5 each and 3,000 ordinary shares of £1 each. Return dated April 27th, 1927. 300 preference and 2,107 ordinary shares taken up. £3,607 paid. Mortgages and charges, nil.

Merthyr Electric Traction and Lighting Co., Ltd.—Capital, £100,000 in 6,000 preference and 14,000 ordinary shares of £5 each. Return dated June 13th, 1927. 6,000 preference and 13,000 ordinary shares taken up. £95,000 paid. Mortgages and charges: £48,400.

Park Royal Engineering Co., Ltd.—Capital, £50,000 in £1 shares. Return dated April 15th (filed May 30th), 1927. 32,700 shares taken up. £31,700 paid, £1,000 considered as paid. Mortgages and charges, nil.

Radioco, Ltd.—Capital, £2,500 in £1 shares. Return dated July 7th, 1927. 2,200 shares taken up. £2,200 paid. Mortgages and charges, nil.

Cecil Hodges & Co., Ltd.—Debenture dated January 9th, 1928, to secure all moneys due or to become due to the debenture holder, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. H. Mabbett, Warwick Lodge, Woodford Green.

Philips Lamps, Ltd.—Capital, £50,000 in £1 shares. Return dated May 25th, 1927. All shares taken up. £50,000 paid. Mortgages and charges, nil.

Minehead Electric Supply Co., Ltd.—Satisfaction in full on December 31st, 1927, of charge dated December 31st, 1920, securing £12,000.

Magna Wire and Cable Co., Ltd.—Capital, £11,000 in 10,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. Return dated November 30th, 1927. 2,027 preference and 11,500 ordinary shares taken up. £2,027 paid on 2,027 preference shares. £575 considered as paid on 11,500 ordinary shares. Mortgages and charges, nil.

Victoria Electric Plant Co., Ltd.—Capital, £1,000 in £1 shares. Return dated October 14th, 1927. 253 shares taken up. £253 paid. Mortgages and charges: £550.

Montevideo Telephone Co., Ltd.—Capital, £220,000 in £1 shares. Return dated December 12th, 1927. 217,135 shares taken up. £217,135 considered as paid. Mortgages and charges, nil.

Radio Company of Great Britain, Ltd.—Capital, £1,000 in £1 shares. Return dated October 31st, 1927. All shares taken up. £100 paid. Mortgages and charges, nil.

C. A. Sidebottom (Dukinfield), Ltd.—Capital, £250 in £1 shares. Return dated October 24th, 1927. 186 shares taken up. £186 paid. Mortgages and charges, nil.

John Collier & Co. (Electrical Engineers), Ltd.—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1 each. Return dated November 11th, 1927. All shares taken up. £2 paid, £19,998 considered as paid. Mortgages and charges, nil.

Newton Brothers (Derby), Ltd.—Capital, £75,000 in £1 shares. Return dated September 20th, 1927. All shares taken up. £30,000 paid, £45,000 considered as paid. Mortgages and charges: £30,000.

Fors Accumulator Foreign Patents, Ltd.—Capital, £3,000 in 952 preference and 2,048 ordinary shares of £1 each. Return dated January 17th, 1927 (filed December 15th, 1927). 584 preference and 2,048 ordinary shares taken up. £132 paid, £2,500 considered as paid. Mortgages and charges: £125.

British General Radio Co. (Retail), Ltd.—Capital, £200 in 1s. shares. Return dated December 3rd, 1927. 3,800 shares taken up. £165 paid, £25 considered as paid. Mortgages and charges, nil.

Jersey Electric Lighting and Power Co., Ltd.—Capital, £65,000 in 51,000 preference and 14,000 ordinary shares of £1 each. Return dated November 7th, 1927. 12,257 preference and 14,000 ordinary shares taken up. £26,257 paid. Mortgages and charges: £12,000.

Embleton & Barker, Ltd.—Capital, £1,000 in £1 shares. Return dated June 2nd, 1927. All shares taken up. £500 paid, £500 considered as paid. Mortgages and charges, nil.

City Notes.

Melbourne Electric Supply Co., Ltd.

The accounts for the year ended August 31st, 1927, show a balance of £288,034 at the credit of the profit and loss account. This compares with £216,142 for the preceding period of nine and three-fifths months. A sum of £399,000 was charged against revenue in accordance with arrangements made with the State Electricity Commission. After providing for debenture interest, &c., and adding sundry receipts, there was a balance of £121,287 available. Of this, £23,500 was placed to income-tax reserve, and a final dividend of 5 per cent. actual was declared on the consolidated ordinary stock (making 10 per cent., free of British tax, for the year), leaving a balance of £290, which will be paid over to the Electricity Commission. The capital expenditure during the year was £407,508.

At the annual meeting on December 14th, the chairman (Mr. Agar Wynne) said that the year had been one of great activity mainly on account of the change-over from single-phase to three-phase in certain areas. The whole of the company's load had now been transferred to the supply system of the State Electricity Commission, and the Richmond station had been closed down. In most cases the company had found positions elsewhere in its business for the displaced employés. A great deal of work had been thrown on the administrative and accountancy departments by the adoption of a new domestic tariff; further standard tariffs would be adopted as from March 1st next. The question of the purchase price of the undertaking had been further considered, and the directors had no reason to alter their previously-expressed opinion that the consolidated ordinary stockholder would receive about 38s. per share.

Simms Motor Units, Ltd.

Speaking at a recent extraordinary meeting, Mr. E. B. Ridsdel said that the proposal to raise the capital from £200,000 to £250,000 was put forward for two reasons. First, for the acquisition of the balance of the shares in the Standard Insulator Co., Ltd., of which they now held 25 per cent., and secondly, for the purpose of providing additional capital for expansion. The business was growing rapidly; about 90 per cent. of the commercial motor vehicles made in this country were equipped with the company's magnetos. The company also claimed to be the largest magneto and dynamo repairers in the country. The Standard Insulator Co.'s manufacturing business consisted mainly of the production of vulcanite parts for Simms magnetos. It also dealt in enamelled copper wires, radio components and various electrical supplies. It was proposed to exchange 25,000 shares of the company for the shares of the Standard Insulator Co. The proposals were approved.

Aldershot Gas, Water, and District Lighting Co., Ltd.

In dealing with the company's electricity department at the annual meeting on Wednesday last, the chairman said that the net increase of sales, apart from special contracts, during 1927 was 19.6 per cent., against 21.7 per cent. in 1926. During the year the Farnborough station was extended, but future supplies would doubtless be through the Central Electricity Board. The prices for electricity had been reduced, and the company was pursuing an active development policy. They anticipated that in a very few years the department would rank in profit-earning capacity with their premier department. The net capital expenditure of the company in 1927 was £89,078, and of this 26.2 per cent. was applied to the electricity department. A new showroom had been opened at North Farnborough and land had been purchased at Fleet for another. As circumstances justified it, further showrooms would be arranged in suitable localities.

Stock Exchange Notices.

Dealings in the following securities have been specially allowed by the Committee under Rule 159:—

Bognor Gas and Electricity Co.—£18,900 new consolidated stock.

Simms Motor Units, Ltd.—25,000 ordinary shares of £1 each, fully paid, Nos. 200,001 to 225,000.

Application has been made to the Committee to allow the following to be officially quoted:—

American Telephone and Telegraph Co.—$3,285,000 capital stock.

Shawinigan Water and Power Co.—100,000 shares of common stock of no par value.

Hall Telephone Accessories (1928), Ltd.

To meet Stock Exchange requirements particulars of this company were published on Wednesday last. The company was formed on January 21st with a capital of £140,000 in fully-paid 10s. shares. Its object is to acquire the private undertaking of Hall Telephone Accessories, Ltd. (in voluntary liquidation) and to carry on the manufacture of telephone coin boxes, automatic stamp-selling machines, ticket-selling machinery, &c. The new company is to pay the old company £9,000 in cash and allot to each member of the old company eight fully-paid shares for each £1 share held.

Para Electric Railways and Lighting Co., Ltd.

The board states that some misunderstanding seems to have arisen in connection with the proposed scheme for capital reorganisation (*vide* ELEC. REV., January 20th, p. 116). The transfer of £52,000 of the reduced capital to a trustee does not confer any additional advantage on the debenture holders, but is for the sole purpose of providing the company with working capital and capital for normal extensions of plant, by the sale of these trustee shares as and when required. The proceeds of these sales will be handed over to the company, to obviate the allocation of an undue proportion of surplus earnings to capital expenditure.

The scheme was considered at an extraordinary meeting on January 23rd when, after some discussion, it was decided to adjourn the meeting until the shareholders had seen the completed accounts for the past year.

Reductions of Capital.

MARCONI INTERNATIONAL CODE CO., LTD., AND REDUCED.—A petition has been presented to the High Court for the reduction of the capital of this company from £50,000 to £25,000, and will be heard in London on January 30th.

PREMIER ELECTRIC WELDING CO., LTD., AND REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £100,000 to £26,250, and will be heard in London on February 28th.

German Borrowing in America.

This week $20,000,000 of 6 per cent. sinking fund gold bonds of the Westphalia United Electric Power Corporation were offered for subscription in New York. Part of the proceeds will be used to extinguish existing indebtedness and the remainder will be devoted to extensions and improvements.

Barcelona Traction, Light and Power Co.

A final dividend of 1 per cent. has been declared on the ordinary stock, making 2 per cent. for the year 1927. An additional dividend of 1 per cent. is also announced on the non-cumulative participating 7 per cent. preference stock.

Westinghouse Brake and Saxby Signal Co., Ltd.

A dividend of 8 per cent. is recommended in respect of the year ended September 30th last, as in the preceding year. The meeting is to be held on February 2nd.

Howard & Bullough, Ltd.

A quarterly dividend of 6d. per share has been declared.

Stocks and Shares.

MONDAY EVENING.

APART from gilt-edged stocks, which have been active on the success of the new Treasury Bond issue and the Indian Loan, there has been a decided diminution of business in practically every section during the week under review. End-account profit-taking has caused a sagging tendency in the miscellaneous market, and rubbers and oils were almost entirely without interest. Dealings for the Mid-February account commenced this morning, and markets firmed up all round without there being, however, any particular feature.

Home Rails.

A little cheerfulness in the heavy group early in the week was damped by a batch of unsatisfactory traffic returns. Metropolitans have sobered down considerably after their activity of the previous fortnight, and have moved within narrow limits, ending the week practically unchanged. There is likely to be more interest taken in this stock during the coming week as the dividend announcement is expected on Thursday. Central London 4 per cent. and Districts also failed to display much activity, but there was a good deal of business doing in Underground Electric ordinary shares and 6 per cent. income stock. The ordinaries have appreciated to 21s. 7½d. in consequence, but the income remains at 109.

Electricity Supply.

With the exception of the unimportant rise of an eighth in the quotation for London Electric 6 per cent. £5 preference shares there is not one price alteration to record in our home electricity list. Nevertheless, this market has, as usual, been very active all through the week meeting with a steady investment demand. Of the London companies, Metropolitans and Counties were inquired for, and there has been continued buying for lock-up purposes of the 5 per cent. debenture stock of the latter, the only debenture stock of this group obtainable, at the moment, in any amount. Shropshire "A" and "B" at 28s. 9d. and 27s. 6d., respectively, were better, and Newcastles were in demand at 23s. 9d., with the new ordinary buyers and sellers at 23s. A bright spot was Newcastle and District ordinary, which changed hands up to 23s. 6d., a rise of 2s. Scottish ordinary and Yorkshire Power ordinary were also harder, and there was a little more activity in North Wales Power ordinary on a basis of 14s. 3d. to 14s. 9d.

Foreign and Colonial Electrics.

Southern Brazil Electric 6 per cent. debenture have been in demand round about 72. As from January 1st the rate of interest has been increased from 6 per cent. to 6½ per cent., making the yield at the present price a shade under 9 per cent. There is a sinking fund which will commence at the end of the year and will be utilised in redemption up to 105. The bonds are being put away by speculative investors, both for the high yield obtainable and for eventual capital appreciation. There has again been very active dealings in Atlas Light and Power ordinary, which have appreciated to 19s. The 7 per cent. preference at 21s. 3d. and the 6 per cent. debenture at 104½ are harder. There has been a little more activity in the Canadian-controlled hydro-electric companies such as Shawinigan Water and Power and Consolidated Gas and Electric of Baltimore, the result of buying orders emanating from Canada where most of the common stock of this group is now held. The Shawinigan Company are offering shareholders of one of their subsidiaries, the St. Maurice Power Company, $175 in cash or two Shawinigan no par value common shares for each St. Maurice $100 common. The present price of Shawinigan common is 92, and is talked considerably higher. It, therefore, looks good business for the St. Maurice common holders to take up the scrip.

Tramways.

Nothing very exciting has happened in the tramway section during the period under review. The preference shares of the London United Tramways and the London Suburban Traction Company are inclined to be harder with the 4 per cent debenture stock of the former in demand round about 56. At this price the yield is 7 per cent. If (or, rather, when) a pooling scheme for the London traffic becomes law, this stock, which is a first charge upon the London United Tramways undertaking, would doubtless rank for interest as a "prior charge." That is to say, if the revenue of the London United Tramways was insufficient to pay the interest, the balance would be a charge upon the surplus revenues of all the other London transport undertakings, *i.e.*, the "pool." It would thus become an exceptionally well secured long-term investment as, apart from the right of the company to repay at 105, the stock is irredeemable. Lancashire United Tramways ordinary are unchanged at 8s. Potteries ordinary at 4s. and preference at 6s. are both 1s. to the good. British Columbia Electric Railway preferred at 156 have shed two points, with the other stocks of the company unchanged. Brazil Traction were out of favour, dropping at one time to 217, subsequently recovering to 219, a drop of three points on the week. Mexican Tramways common were steady at 32. Ceara Tramways 5 per cent. debenture experienced a sharp jump of 5 points to 60. Anglo-Argentine Tramways securities were inactive and unchanged in price. The scheme for reduction and rearrangement of capital of the Para Electric Railway and Lighting Company, Ltd., met with a very hostile reception at the extraordinary general meeting held this morning. The ordinary shareholders strongly objected to having their holdings reduced from the nominal £1 to a nominal 2s. 8d., and having to share their equity with the preference shareholders, especially in view of the steady progress shown by the company during the last few years and the possibility of the Brazilian milreis not being definitely stabilised at its present depreciated value of slightly under 6d. After lengthy discussions the meeting was adjourned to enable the board to publish the report for the year ended November 30th last and to get into touch with some of the larger ordinary shareholders with a view to a possible modification of the present proposals which do appear to deal somewhat harshly with the present holders of the equity.

Cables.

With the exception of a drop of 2½ in Eastern Telegraph ordinary and 2 in the Great Northern Telegraph ordinary, the submarine cable group held their gains of the previous week, although, as was rather to be expected, business was on a smaller scale. Oriental Telephones at 51s. 3d. were a shade higher. Anglo-American Telegraph 6 per cent. preferred attained parity by adding 2½ points to their quotation. The wireless group was also not so active. Marconis moved within narrow limits, but firmed up for "New-Time," and are now 51s. 6d., after being slightly higher. The convertible debenture stock touched 145, but sagged on end-account profit, dropping to 130, from which price it quickly jumped to 140—again for "New-Time." Marconi Marines sagged to 35s., but afterwards recovered, and were in fairly active demand round about 37s. 6d. A dull spot was Canadian Marconi, which was no better than 14s. 6d. A newcomer this week was the 5½ per cent. debenture stock of Edison Swan Cables, Ltd., of which a large parcel was placed at about 98. The stock is guaranteed unconditionally by the Edison Swan Electric Company (who hold the control), and interest is covered by this guarantee some 11 times over. The stock was quickly taken off the market for investment purposes.

Manufacturing.

The market was distinctly disappointed with the 8 per cent. dividend announced by the Westinghouse Brake and Saxby Signal Company on Friday. Expectations ran from anything between 9 per cent. and 12 per cent., and the price was dropped sharply to 30s., as against as high as 36s. earlier in the month. The report itself is expected in a few days. Consolidated Signals were 40s. in sympathy. The advent of the Edison Swan Cables debenture stock causes a little interest in the 5 per cent. and 5½ per cent. stocks of the parent concerns which were marked up, now being 89 and 92, respectively. It was pointed out by a dealer that if Edison Swan Cable 5½ per cent. debenture is worth 98, then the two debentures of the Edison Swan Electric Company which rank before it, are some six points undervalued! Babcock & Wilcox are again better at 64s. 3d., as are Telegraph Construction £12 ordinary at 25½. There has been small inquiry for British Electric Transformer ordinary at 17s. 9d. on hopes of an increased dividend. For 1926 the company had to provide six months' arrears of preference dividend, after which it paid 5 per cent. on the ordinary. The argument is that, as this six months' arrears of preference dividend equals another 3 per cent. on the ordinary and as the company should have done, anyway, as well during 1927 as in 1926, there is a sporting chance of something in the neighbourhood of 8 per cent. forthcoming for last year! Of the larger electrical manufacturing concerns, Met-Vickers, Johnson & Phillips, Siemens and General Electric all firmed up, and there was quite a lot of buying of the 8 per cent. preference and 6 per cent. preferred of Crompton-Parkinson, Ltd., at 25s. and 17s., respectively.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Jan. 23 1928.	Rise or fall.	Yield.
HOME ELECTRICITY COMPANIES.	£					p.c.
Bournemouth and Poole	1	14†	14†	60/6	—	4 12 10
Brompton Ordinary	1	10	8½	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	25/6	—	5 9 10
City of London	1	15	10	30/-	—	4 13 4
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	32/-	—	5 0 0
County of London	1	15	7½	29/-	—	4 16 7
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	8	10	45/-cd	—	4 8 11
do. 7% Pref.	1	7	7	25/6xd	—	5 9 10
Elec. Supply Corporation	1	11	11	35/-	—	6 5 9
Kensington Ordinary	1	15	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	25/6	—	5 9 10
do. do. 6% Pref.	5	6	6	5½	+¼	5 8 2
Metropolitan	1	11	8	30/-	—	4 13 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	6	6	24/-	—	5 0 10
Newcastle-on-Tyne Ordinary ...	1	7	5	23/9	—	4 4 3
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	8	27/-	—	5 3 8
South London	1	15	8½	25/6	—	5 9 10
South Metropolitan Pref.	1	7	7	1½	—	6 3 0
Urban Ordinary	1	7	7	40/-	—	3 10 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	21/4½	—	7 0 4
Yorkshire Elec.	1	8	8	33/-	—	4 17 0
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	74	—	5 8 1
Metropolitan	,,	5	3	70	—	4 5 9
do. District	,,	9½	3½	69	—	5 1 5
Underground Electric	£1	Nil	1½	21/7½	+3d.	1 7 8
do. do. Income ...	Bonds	6	6	109	—	5 10 1
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	+2½	6 0 0
do Def.	,,	1½	1½	24½	—	6 3 9
Automatic Telephone	1	3	10	46/3	—	4 6 6
Chili Telephone	5	5	6	7⅞xd	—	3 18 3
Eastern Extension	10	10	10	15½xd	—	*6 9 10
Eastern Tel. Ord.	Stock	10	10	145xd	−2½	*6 17 11
Globe Tel. and T. Ord.	10	10	10	15½	—	*6 9 0
do. do. Pref.	10	6	6	10½	—	5 4 6
Great Northern Tel.	10	20	20	39	−2	5 2 7
Indo-European	25	8½	10	35	—	*6 1 5
Marconi	10/-	Nil	5	51/6	+1/6	1 18 10
Marconi-Marine	1	7½	8¾	37/9	+1/6	4 12 8
Oriental Telephone Ord.	1	12	12	51/3	+1/3	*4 13 6
United R. Plate Tel.	5	8	8	10¾	—	*3 17 1
Western Telegraph	10	10	10	15	—	*6 13 4
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅞	—	7 14 5
do. do. 2nd Pref. ...	5	6	6	3¾	—	8 5 6
do. do. 5% Deb. ...	Stock	5	5	75½	—	6 12 5
British Electric Traction Def. Ord.	,,	—	—	500	—	... ...
do. do. 8% Pref. Ord.	,,	7	8	124½	—	6 8 6
Brazil Traction	100	5	6	219	−3	2 14 7
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	99½xd	—	5 6 11
do. do. Preferred ...	,,	6½	6½	156	−2	*4 0 2
do. do. Deferred ...	,,	8	8	195½	—	*4 1 10
do. do. Deb.... ...	,,	4½	4½	84½	—	5 0 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	8/-	—	... ...
London United Tram Deb. ...	Stock	4	4	55½	—	7 4 2
Mexico Trams, 5% Bonds	—	5	5	76	−3	6 11 7
Mexico Light Common	100	Nil	Nil	62	−5	... ...
do. Pref...	100	Nil	Nil	80	—	... ...
do. 1st Bonds	—	5	5	82½	—	6 4 0
Yorkshire (West Riding)	1	5	—	7/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	13	13	64/3	+6d.	4 1 3
British Aluminium Ord.	1	12½	10	50/-	—	4 0 0
British Elec. Transformer Pref. ...	1	7	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	4¼	—	3 12 8
Brush Ord.	1	10	10	30/-	—	6 13 4
Callenders	1	15	15	3⅛	—	3 16 4
do. 6½% Pref.	1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord. ...	1	—	—	16/6	—	... ...
Edison-Swan	4/-	10	10	10/-xd	—	4 0 0
do. 5% Deb.	Stock	5	5	89	+1	5 12 4
Electric Construction	1	10	7½	25/-	—	6 0 0
Enfield Cable Pref.	1	7½	7½	23/9	—	6 6 0
English Electric	1	Nil	Nil	9/6	—	... ...
do. do. Pref.	1	6	3	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	+6d.	5 8 4
do. Ord.	1	7½	7½	34/-	+6d.	4 8 3
Henley	1	20	25	109/6	—	4 17 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	Nil	13/9	—	... ...
Johnson & Phillips	1	17½	12½	51/9	—	4 15 10
Met.-Vickers Ord.	1	8	8	80/-	—	5 6 8
do. Pref.	2	8	8	2⅞	—	6 4 8
Siemens Ord.	1	7	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	23½	+1	*4 14 1

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

Britain's Foreign Electrical Trade.

Statistics and Comparisons.

WITH the publication of the Board of Trade returns for December, another year's figures are available, and in accordance with our custom we give below particulars of the course of our foreign electrical trade during the past year.

Dealing in the first place with the December figures themselves, it will be observed that exports fell considerably in comparison with November, and they were also below the December, 1926, figure. In comparing the items with those of November, only three small increases are noted; in every other case there was a decline. The greatest fall occurred in unenumerated electrical machinery (£82,271), and the total decrease in the machinery section was thus £130,129. The telegraph and telephone section was also seriously affected. Submarine cable registered a fall of £53,710, while the total decline in this group was £98,096. Unenumerated electrical goods and apparatus were £26,453 lower than in November, and insulated wires and cables were £36,682 lower. In the comparison with December, 1926, the increases predominated in number, but not in magnitude. The largest decrease was one of £57,612 in insulated wires and cables. A rise of £23,554 in unenumerated electrical machinery was overbalanced by a fall of £41,188 in railway and tramway motors, while "other" motors and generators also declined by £5,809. Other notable items were batteries and accumulators (£14,928 decrease) and telegraph and telephone instruments and apparatus (£15,104 increase). Imports during December remained at about the same level; although the increases were greater in number, there was a small decrease in the total. The principal rise was in unenumerated electrical machinery (£19,255); this was countered by a fall of £27,363 in unenumerated goods and apparatus. There was a fairly substantial rise in the total as compared with December, 1926. This was contributed chiefly by glow lamps (£16,030), batteries and accumulators (£12,759), and insulated wires and cables (£11,853). Except for a fall of £2,058 in carbons, the decreases were negligible. The re-export section showed a rise in both comparisons, unenumerated electrical machinery exhibiting a notable increase as against December, 1926.

We give in the next table an analysis of British exports of electrical machinery during December, 1927, and the whole of the past year, with corresponding figures for comparative purposes.

The third table compares the total figures for the past two years. The export section requires a repetition of the explanation which we gave last week. Up to November there had been an increase of £648,595 as compared with the first eleven months of 1926, and although the decrease in December was only £62,598, the totals indicate a decrease of £591,664 in exports as compared with 1926. Upon inquiry at the Government Department concerned, we were told that the discrepancy

Table I.—Exports and Imports during December, 1927.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Dec., 1927.	Inc. or dec. as compared with Nov., 1927.	Inc. or dec. as compared with Dec., 1926.	Electrical imports for Dec., 1927.	Inc. or dec. as compared with Nov., 1927.	Inc. or dec. as compared with Dec., 1926.	Electrical re-exports for Dec., 1927.	Inc. or dec. as compared with Nov., 1927.	Inc. or dec. as compared with Dec., 1926.
Electrical goods and apparatus (unenumerated)	£196,268	−£26,453	+£6,238	£124,347	−£27,363	+£1,681	£8,263	+£2,134	−£1,619
Insulated wires and cables ...	237,996	− 36,682	− 57,612	68,371	+ 9,468	+ 11,853	1,839	+ 905	+ 1,370
Glow lamps	54,019	+ 1,031	+ 7,306	57,886	+ 4,703	+ 16,030	1,127	+ 247	− 38
Arc lamps and parts	1,200	+ 597	+ 475	4,360	+ 1,256	+ 557	392	+ 241	+ 386
Batteries and accumulators ...	8[illegible],599	+ 1,459	− 14,928	79,947	− 10,719	+ 12,759	1,614	+ 1,116	− 786
Meters and instruments ...	33,488	− 7,807	+ 5,954	29,136	+ 924	+ 3,208	482	+ 28	+ 320
Carbons	647	− 2,926	− 2,387	9,433	+ 502	− 2,058	67	+ 51	+ 50
Electrical Machinery—									
Electrical machinery (unenumerated)	283,110	− 82,271	+ 23,554	146,900	+ 19,255	+ 1,110	14,897	+ 735	+ 7,199
Railway and tramway motors	8,100	− 29,852	− 41,188	—	—	—	—	—	—
Other motors and generators...	197,038	− 18,006	− 5,809	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	7,854	− 173	+ 467	72	+ 50	− 728	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	69,770	− 37,460	− 4,032	11,708	− 6,084	− 163	262	+ 262	+ 254
Submarine telegraph and telephone cable...	17,977	− 53,710	+ 4,260	—	− 56	—	—	—	—
Telegraph and telephone instruments and apparatus ...	274,733	− 6,926	+ 15,104	59,975	− 2,791	+ 7,007	2,065	− 2,807	− 5,065
Totals	£1,471,799	−£299,179	− £62,598	£592,125	− £10,855	+ £51,256	£31,008	+£2,912	+£2,021

Table II.—Exports of Electrical Machinery.

Destination.	Dec. 1926.	Dec. 1927.	Inc. or dec.	1926.	1927.	Inc. or dec.
	£	£	£	£	£	£
European Countries	82,700	59,297	− 23,403	95[illegible],947	933,086	− 2[illegible],861
South America	26,332	44,795	+ 18,463	410,626	576,856	+ 166,230
Japan	8,623	6,858	− 1,765	178,520	318,587	+ 139,067
South Africa	79,514	57,168	− 22,346	703,669	1,041,522	+ 337,853
British India	98,467	105,019	+ 6,552	1,306,981	1,152,704	− 154,277
Australia	79,503	64,416	− 15,087	988,260	1,254,937	+ 266,677
New Zealand	29,118	44,577	+ 15,459	283,518	426,738	+ 143,220
Canada	16,255	16,666	+ 451	231,795	238,494	+ 6,179
Other Countries	91,219	89,452	− 1,767	758,225	768,193	+ 9,968
Totals	£511,691	£488,248	− £23,443	£5,817,461	£6,710,817	+ £894,356

was due to a belated entry of a large quantity of submarine cable in the 1926 figures. It is unfortunate that such a thing should occur to alter the whole com-

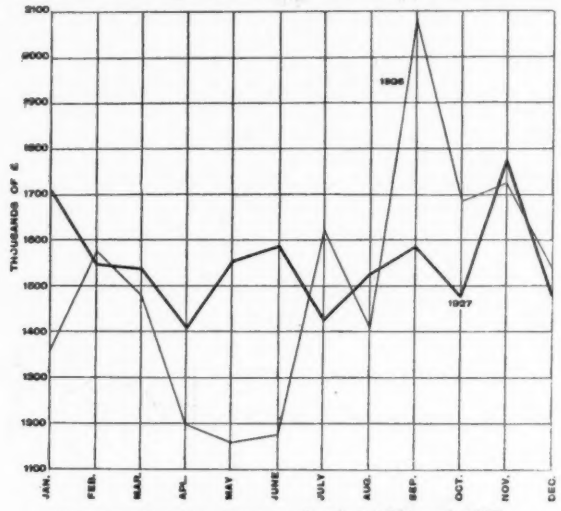


Fig. 1.—Monthly Exports During 1926 and 1927.

plexion of the export trade, but it will be seen that if the abnormal item of submarine cable is omitted, the exports showed an increase of £861,354.

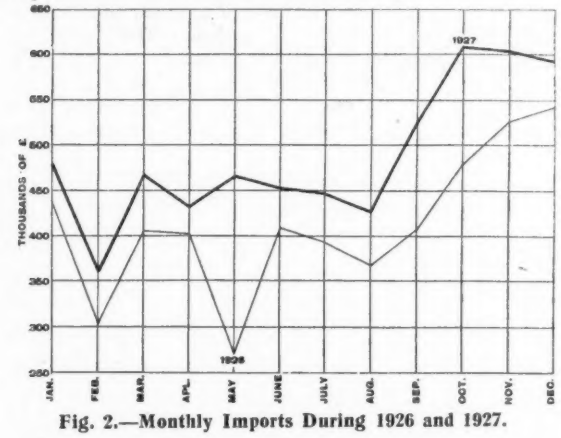


Fig. 2.—Monthly Imports During 1926 and 1927.

Comparing the two years' figures, it is seen that a substantial increase was recorded by unenumerated electrical machinery (£761,633). The other two machinery items also increased, though not to such a great extent. An increase of £302,230 in unenumerated electrical goods and apparatus was balanced by a fall of £316,436 in insulated wires and cables. Non-submarine telegraph and telephone cables showed a fairly satisfactory increase, but telegraph and telephone apparatus fell to the extent of £449,056. The import section showed a very substantial rise—£907,527, or over 20 per cent. Unenumerated machinery predominated with an increase of £438,698, and three other items were higher by more than £100,000, namely, unenumerated goods, insulated wires and cables, and glow lamps. All three items of the telegraph and telephone group reached lower levels, as did switchboards. Except for a rise of £34,635 in unenumerated machinery and a fall of £12,988 in unenumerated goods, there was little change in the re-export section.

The first curve (fig. 1) illustrates the course of exports, month by month, during the past two years.

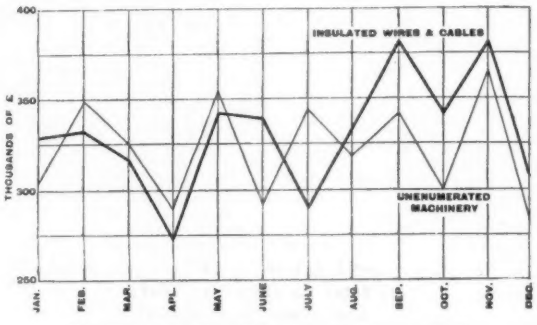


Fig. 3.—Two Leading Export Items, 1927.

The most apparent feature of these is that during 1927 the monthly fluctuations were far less violent than in the preceding year. It should be said that the curves, being compiled from the monthly figures, take no account of the submarine cable "extra," to which reference has been made above. The high peak in 1926 was, of course, due to an abnormal export of submarine cable; the very low point in May of that year marked the effect of the general strike. Electrical export trade appears to have settled down during the year; the general tendency, although not very definite, appears to be upward in spite of the fall in December.

Fig. 2 shows that imports during 1927 were consistently above those of 1926. Except for the sudden

Table III.—Exports and Imports during 1926 and 1927.

	Exports.			Imports.			Re-exports.		
	Electrical exports, 1926.	Electrical exports, 1927.	Inc. or dec. in 1927 as compared with 1926.	Electrical imports, 1926.	Electrical imports, 1927.	Inc. or dec. in 1927 as compared with 1926.	Electrical re-exports 1926.	Electrical re-exports 1927.	Inc. or dec. in 1927 as compared with 1926.
Electrical goods and apparatus (unenumerated) ..	£2,046,053	£2,348,283	+£302,230	£1,212,100	£1,317,233	+£105,133	£73,141	£60,153	−£12,988
Insulated wires and cables	3,346,593	3,030,157	− 316,436	598,129	740,221	+ 142,092	15,117	10,298	− 4,819
Glow lamps	500,963	593,274	+ 92,311	335,059	435,323	+ 100,264	12,270	14,885	+ 2,615
Arc lamps and parts ...	9,634	21,680	+ 12,046	21,457	37,471	+ 16,014	1,838	2,135	+ 297
Batteries and accumulators	1,019,487	1,233,668	+ 214,181	652,722	746,620	+ 93,898	12,348	6,560	− 5,788
Meters and instruments ...	389,002	374,181	− 14,821	219,400	288,216	+ 68,816	7,994	9,178	+ 1,184
Carbons	18,306	24,625	+ 6,319	93,559	94,031	+ 472	1,416	628	− 788
Electrical Machinery—									
Electrical machinery (unenumerated)	3,100,399	3,862,032	+ 761,633	1,158,647	1,597,345	+ 438,698	81,749	116,384	+ 34,635
Railway & tramway motors	487,491	495,159	+ 7,668	—	—	—	—	—	—
Other motors and generators	2,229,571	2,353,626	+ 124,055	—	—	—	—	—	—
Switchboards (not telegraph or telephone) ...	84,782	71,524	− 10,258	2,127	1,252	− 875	68	7	− 61
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	823,290	954,772	+ 131,482	151,866	108,679	− 43,187	4,425	3,412	− 1,013
Submarine telegraph and telephone cable	2,001,016	547,998	−1,453,018	6,986	129	− 6,857	—	—	—
Telegraph and telephone instruments and apparatus...	3,126,768	2,677,712	− 449,056	493,885	486,944	− 6,941	52,092	42,288	− 9,804
Totals	£19,183,355	£18,591,691	−£591,664	£4,945,937	£5,853,461	+£907,527	£262,458	£265,928	+ £3,470

fall in May, 1926, the curves run together very closely, and the trend seems to be towards the maintenance of imports on a fairly high level. The principal contributors to the increased foreign purchases have been shown above to be machinery, insulated wires and cables, unenumerated goods, and glow lamps.

The next two sets of curves deal with the leading export items. Except for the middle of the year, the exports of wires and cables (which include non-submarine telegraph and telephone cables) and unenumerated machinery (fig. 3) followed one another in their fluctuations. The influence of the cable item, especially,

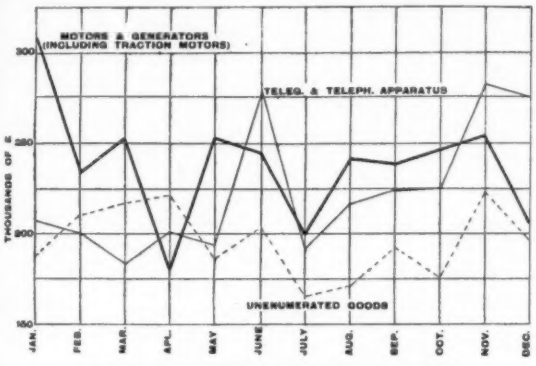


Fig. 4.—Three Classes of Exports, 1927.

is seen in the general resemblance which the curve bears to the curve showing total exports. The high level reached by the total in January, 1927, appears to be attributable to other items, notably motors and generators (including traction motors), fig. 4. The last-mentioned curves indicate that the motor and generator class was unable to regain its high January level, although it rose three times above the figure of £250,000. Telegraph and telephone apparatus made two high jumps during the year. That in June could not be maintained, but there was a more gradual rise to the highest point in November, and only a small decline in the last month of the year. Unenumerated electrical goods pursued a more or less even tenor, the average monthly shipment being in the neighbourhood of £200,000.

The final curves (fig. 5) illustrate the movements of three leading export items during 1927. The principal one was unenumerated machinery, which rose to a high level in May. Its influence upon the total for the first six months of the year is seen when figs. 2 and 5 are

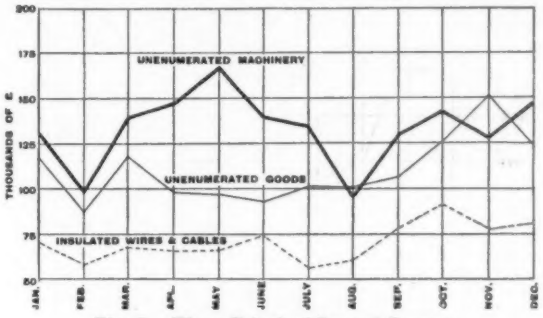


Fig. 5.—Three Principal Import Groups.

compared. Towards the close of the year other factors predominated in the import list. The imports of unenumerated goods and insulated wires and cables (again including the non-submarine telegraph and telephone class) moved fairly evenly during the year. Unenumerated goods rose above machinery on two occasions.

The E.C.A. Allied Associations.

Annual Dinner.

As we briefly reported in our last issue, the annual dinner of the Electrical Contractors' Association (Inc.), the N.E.C.T.A., Ltd., and the National Federated Electrical Association was held at the Trocadero, W., on January 17th. The president (Mr. W. A. Shaw, A.M.I.E.E.) occupied the chair, and about 260 people were present, including one of the two lady members of the E.C.A.

After the loyal toast, Col. the Right Hon. Wilfrid Ashley, M.P., Minister of Transport, proposed "The Allied Associations and Honorary Officials." After referring to the excellent co-operative spirit manifested by the Association, the speaker said that when he attended the last annual dinner, the Electricity (Supply) Act, 1926, had just been added to the Statute Book. There were then many doubts regarding the measure, but public opinion had come round to consider that it would be of benefit to the country in the very near future. He claimed that the Central Electricity Board was proving to be an excellent body. It had put through the Central Scotland scheme and already the effects were beginning to be felt by the electrical industry. The South-East England scheme had met with many anticipated difficulties, but these had been largely overcome by the tact and consideration of the Board. While the Board, the Electricity Commissioners, the contractors and others concerned could adequately cater for urban electrical development, something more was required if rural districts were to enjoy the advantages of electricity. In most country areas the supply of electricity was not a commercial proposition. During the last six months he had given earnest consideration to the problem of speeding up rural development on natural lines, and with the aid of the Commissioners and the Board the matter had proceeded a good way. He hoped within a short time to place before the Government proposals for affording a supply to many rural areas.

In the course of his reply to the toast, Mr. W. A. SHAW said that there was never a time when the various sections of the industry were so anxious to co-operate. The exaggerated statements regarding the price of electricity which had appeared in the daily Press were causing delay in development, and the Board and the Commissioners would do the industry great service by emphatically contradicting these wild stories. Although the contractor was talking to the public all day and every day, he could not make headway against the exaggerations of the Press. Dealing with Clause 48 of the Electricity (Supply) Act, he said that it presented a favourable means of co-operation between supply engineers and contractors. A welcome spirit was abroad, as was instanced by the recent agreement made at Croydon by which registered contractors were given installation work by the Corporation at fair prices and were allowed to use the Corporation electrical showroom. It was imperative that hire and hire-purchase wiring schemes should be carried out with high-class material and labour. In some areas prices had been cut to such an extent that the so-called contractors could use nothing but rubbish in their work. It was to be hoped that supply authorities would exercise very close inspection of installations. He was glad to note the improved relations which now existed between the employers and employés of the industry. After referring to the growing strength of the Association, Mr. Shaw said that it was still far too easy for anybody to set himself up as an installation engineer. He was strongly in favour of the compulsory registration of contractors, and he thought that the Central Board would do a national service if it demanded a satisfactory standard of installation work. At West Ham, Mr. Purse had persuaded his Council to adopt the I.E.E. Wiring Rules. Such a precedent was invaluable and should encourage other authorities to follow suit.

Mr. H. J. MILES proposed the health of the guests. He said that last year they had invited Col. Ashley to the dinner to show their appreciation of the vast amount of work which he had done in connection with the Electricity (Supply) Act and to demonstrate their willingness to co-operate to make the Act a success. They realised how much the Commissioners and the Board had to contend with, for contractors were probably the greatest sufferers from the lack of uniformity and standardisation which existed to-day. The B.E.A.M.A. had secured thorough protection under the Act, for municipal supply authorities were not to be allowed to manufacture appliances. They could, however, do installation work, but if the contractors gave them the square deal which they were entitled to expect, he did not think that they would want to do it.

Sir HARRY HAWARD (vice-chairman of the Electricity Commission), responding, detailed the long procedure which preceded the supply of electricity, and said that the contractors were the last link in the chain, and a very important link. There was a growing appreciation among local supply undertakings of the vital work done by the contrac-

tors, and they were securing the contractors' assistance in the carrying out of wiring and hiring schemes. The institution of these schemes might be called the key to the position, although many authorities were still reluctant to embark upon them. It might be that some new form of organisation would be necessary to undertake rural electrification. Proceeding, Sir Harry said that the question of regulations for ensuring the safety of the public had given the Commissioners a great deal of trouble. They hesitated to adopt the I.E.E. Rules as they stood; even the I.E.E. Committee had its differences. There were two conflicting opinions: that the utmost precautions should be taken by the employment of only the highest class of material and labour; and that this could be carried too far owing to the cost involved. The two views had to be balanced up to secure a reasonable degree of safety combined with reasonable cost. The demand for compulsory registration was strange when the Commissioners were being asked to relax other regulations. West Ham's precedent might be a satisfactory one, but before it could be generally adopted the results would have to be studied. In conclusion, the speaker said that the contractors' work was none the less important, because it covered small matters; the Commissioners regarded it as vital.

Mr FRANK HODGES (Central Electricity Board), who also replied, said that the Board aimed at being independent of whatever Government happened to be in power. With regard to the Central Scotland scheme, he said that the contract for the transformers had yet to be awarded. Not one penny of the vast expenditure upon the scheme would go to a foreign firm. On the Board he was the representative of the industrial classes, and as such he could not countenance the entry of materials from abroad which had been produced on a lower labour standard than that which prevailed in this country. Even if they were as good as British, though cheaper, through being based on cheap labour, they should be rejected. He was not in favour of compulsory rules: he would rather see rules imposed by the industry itself. That could be done when all contractors were members of the Association; but there were still many "non-unionists" as in other directions. He claimed that if it was necessary to safeguard human life in mines, it was just as essential that similar regulations should be applied in other spheres. Prospective consumers were unwise to wait for cheaper electricity. There would be an enormous rush then: his advice was "Do it now!"

Mr. F. W. PURSE (president, I.M.E.A.) said that he could speak as a contractor. Fifty per cent. of the installation work in West Ham was done by his Department. The Department had adhered to the I.E.E. Rules in its own work and had not lost a kilowatt of load by it. He indulged in some light banter at the expense of the Ministry of Transport, the Central Board, and the Commissioners, saying that eventually, it appeared, municipal supply engineers would be roasted on the "grid"; or they might be permitted to join the contractors. He hoped that some of the developments which were at present held up would be allowed to proceed. Some of the local authorities were uncertain as to their future source of supply and as to the price when they received the supply. Too much was being made of "diversity," and the attempt to curtail the amount of spare plant might prove unwise.

Col. R. K. MORCOM (chairman, B.E.A.M.A.), winding up the replies for the guests, said that he would reverse Sir Harry Haward's order of things, and say that the contractor was the first and not the final link in the chain. His efforts led eventually to orders for power plant; he was the finest propagandist of the industry.

Mr. H. J. CASH proposed the toast of "The Electrical Trades Benevolent Institution," to which Mr. J. W. BEAUCHAMP (president, E.T.B.I.) responded, and the chairman briefly acknowledged the toast of his health, proposed by Mr. W. CROSS. Songs were rendered during the evening by Miss Edith Furmedge and Mr. Thorpe Bates, accompanied by Mr. George Ison.

The Institution of Electrical Engineers.

Annual Dinner of the North-Western Centre.

THE annual dinner of the North-Western Centre of the Institution of Electrical Engineers was held on Tuesday, January 17th, at the Midland Hotel, Manchester, and was attended by 252 guests, among whom were the President of the Institution (Mr. Archibald Page), the Lord Mayor of Manchester (Councillor W. Davy), the Mayor of Salford (Alderman A. Williamson), the Rt. Hon. J. R. Clynes, P.C., M.P., Sir A. R. Duncan, Dr. S. L. Pearce, C.B.E., Mr. E. A. Radford, M.P., Alderman W. Walker, Mr. W. E. Thompson (President of the Manchester Chamber of Commerce), Mr. S. H. Heywood (President of the Manchester Association of Engineers), and the presidents or chairmen of the local sections of other engineering societies.

Mr. A. B. MALLINSON, Chairman of the North-Western Centre, presided.

In proposing the toast of "The Cities and Trade of Manchester and Salford," Mr. B. MOUAT JONES, D.S.O., Principal of the Manchester College of Technology, said he would speak of the two cities as a whole—and what a whole! He observed that the audience apparently placed the worse construction on that word. It was the most important engineering centre in the country, the metropolis of cotton, one of the numerous third largest ports in the Kingdom, and the birthplace of two magnetic personalities—Mr. Lloyd George and the electric hare!

The toast was replied to by the LORD MAYOR OF MANCHESTER, who said the city had played a leading part in the development of the electrical industry. It had shown initiative, introduced new ideas, and trained men for work in other parts of the country.

The Rt. Hon. J. R. CLYNES proposed the toast of "The Institution of Electrical Engineers." He said electricity was a mighty and compelling force, and the brain power and genius of the men who had charge of the production and distribution of it would enable it to give even more beneficent service than had been given in the past. Other considerations than material reward must be taken into account in national and civic service, but he sometimes thought many public authorities were too niggardly and forgot the necessity for securing and retaining in their service men of the best type by paying for the best.

In 1927 there was less trade disturbance, less cessation of work through strikes and lock-outs than in any year for nearly half a century. He believed they were now on the threshold of a more harmonious era in the matter of industrial relations, and he hoped the conference between representatives of the employers and the employed would increase the disposition on both sides to do the right thing in their own interests and in the national interest as well. The establishment of numerous welfare departments was another proof that the country was emerging from the stage when bitterness prevailed in industry. A great deal had been learned from experience of industrial conflict. Looking farther afield, there were hopes of improved international relations. Success in that direction—the establishment of a League of Nations to which countries would turn for the pacific settlement of disputes—must react beneficially upon internal relations. He believed that, both internationally and industrially, the end of 1928 would be better than the beginning.

Mr. A. PAGE, responding to the toast, said he had attended a series of local Centre dinners, as President of the Institution, and he had observed that on each occasion the proposer of this toast approached the subject from a different point of view. To his mind that showed that the Institution attracted and even riveted the attention of distinguished people in every sphere of work. In the application of electricity unprecedented progress had been made in recent years, but the demand for more was still heard in industry, in the home, in the hospital. Co-operation between the scientist, the research worker, the inventor, and the engineer would lead to the fuller utilisation of this fundamental dynamic power. He would be a very bold man who ventured to prophesy what 20 years would bring forth; the possibilities were boundless. It was a main function of the Institution to facilitate the exchange of knowledge and experience, and it was going from strength to strength; already the membership was well over 12,000, and new blood was coming in every year. Nowhere had progress been more marked than in South-East Lancashire. The North-Western Centre was the largest of the branches, and was very active; the Advisory Committee on Electricity Supply had produced order out of chaos, and he knew no other instance in which team work had been so effective in the public interest. He was glad to pay this tribute to the single-mindedness of those who had contributed to that splendid result. Manchester was also entitled to feel some pride in the position it held with regard to efficiency in generation; Barton was easily the most efficient station in this country, and it enabled them to range Britain alongside of the best of Cousin Jonathan's mammoth stations. It was the outcome of the engineering skill of Dr. Pearce, of Mr. Lamb, and of their able assistants, who had shown that they knew how to run a good plant with the highest economy and the best results. He must also refer to Alderman Walker. When the Government wanted a good man and true they turned their eye to Lancashire and saw Alderman Walker. What Dr. Pearce did with inanimate material, Alderman Walker did as skilfully with animate material. The work of the Central Electricity Board had to be run on certain lines, and in the long run it would bring about a much-improved state of affairs to the advantage of individuals, as well as of the general body. The Institution would endorse and encourage progress in every shape and form, because its aim was to make electrical knowledge part of the inheritance of every undertaking and every individual.

The CHAIRMAN proposed the toast of "The Guests," which was replied to by Mr. DOUGLAS MILLER, the High Master of the Manchester Grammar School.

A programme of music was performed during the dinner, and an interesting interlude between it and the speeches was provided by the singing of Madame C. Delambre and Mr. Serge Lavroff—a novel feature.

The "Change-Circuit" System.

As a means of maintaining a constant high load factor the system described below embodies an automatically variable heat-storage load, inversely to the ordinary load.

IT is an established fact that by filling up the valleys in the electricity supply undertaking's load curve the increased cost of production is very little more than the cost of the fuel. Any scheme, therefore, which aims at improving the load factor is worthy of the careful consideration of power station engineers, and the "change-circuit" system described in the following notes is of particular interest.

The object of the scheme, which is a development of Mr. Geo. Wilkinson, Harrogate, and the English Electric Co., Ltd., is to maintain a practically constant total load by the automatic adjustment of thermal-storage load so as to vary this inversely with the ordinary load.

Essentially the scheme employs two independent feeders with a common line; one feeder is maintained at constant voltage for the usual supplies, while the other functions at a variable pressure to supply thermal-storage and similar apparatus. The pressure of the "change-circuit" feeder is automatically varied so as to maintain the sum of the loads at approximately full load continuously. For the voltage variation "English Electric" induction regulators have been adopted. The scheme could be applied to existing systems merely by the addition of the regulator and an extra feeder per phase, so that a three-phase four-wire system would become a three-phase seven-wire system, and a single-phase three-wire system would have five wires. The pressure of the thermal-load circuit is twice that of the normal supply voltage, and is automatically regulated, therefore the extra conductors need be only of relatively small sectional area.

Fig. 1 shows, diagrammatically, the scheme of connections for a three-phase four-wire system. The induction regulator is designed with a 1/1 ratio and the rotor and stator windings are connected in series. By this means a cheap and efficient regulator is obtained for giving a voltage range of from zero to double line volts. When the transformer is fully loaded with ordinary load the voltage across the regulator is zero, and no power is supplied to the thermal-storage circuit. When the ordinary load falls to its minimum, however, the regulator gives the maximum pressure for the thermal-storage supply, which maintains the total load constant.

For new sub-stations a cheaper arrangement is the "English Electric" patented double-range regulator, wherein the size of the regulator is reduced by 50 per cent. and the losses are also lessened. This is shown diagrammatically in fig. 2 with a single-phase transformer; it can also be used for three-wire, and three-phase four-wire circuits.

Where it may be desirable to utilise a tapping switch instead of the induction regulator, the arrangement depicted in fig. 3 should prove suitable. In such cases, however, the maximum voltage on the "change-circuit" will be the same as the normal supply pressure. The tapped secondary need not have very fine steps, and economy suggests comparatively few.

The automatic control gear for ordinary feeder voltage regulators, which must maintain a voltage of within ± 1 per cent. of some predetermined value, is an expensive item, and the cost would be prohibitive for "change-circuit" applications in which a variation of ± 5 per cent. or even more is allowable. A simplified arrangement has therefore been developed which is shown diagrammatically in fig. 4. It is the maintenance of constant current on the input side of the transformer that is aimed at, and therefore the control impulse is initiated from a current transformer in series with the primary supply feeder. The secondary current, which is proportional to the line current, heats a thermostatic strip consisting of two different nickel-iron alloys rolled together. This strip is flat at 15 deg. C. and deflects with any increase of temperature. The free end of the strip works between two contacts which are adjusted so that no contact is made either way with normal full-load current. If the load varies, however, contact is made in one direction or the other, thus closing the contactor circuit for "raise volts" or "lower volts" on the "change-circuit" regulator. To compensate for changes of atmospheric temperatures, the contacts are carried on similar bi-metal strips designed to ensure uniform spacing of the contacts at all atmospheric temperatures. This feature is also utilised to incorporate another compensation. The amount of surplus load which can be absorbed in thermal storage will vary according to the time of the year. By installing another current transformer in the change-circuit feeder, and causing the current to heat the bi-metal strips which carry the relay contacts,

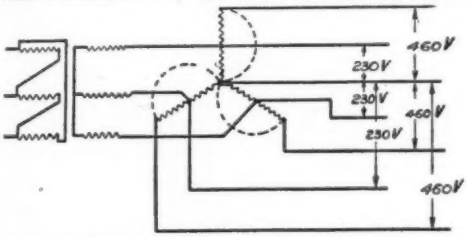


Fig. 1.—Three-phase, Four-wire System, with Induction Regulator.

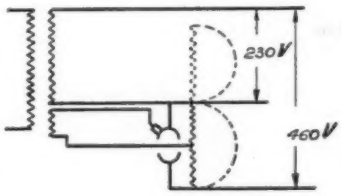


Fig. 2.—Connections for Double-range Regulator.

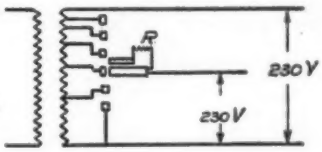


Fig. 3.—Arrangement for Tapping-Switch Regulator.

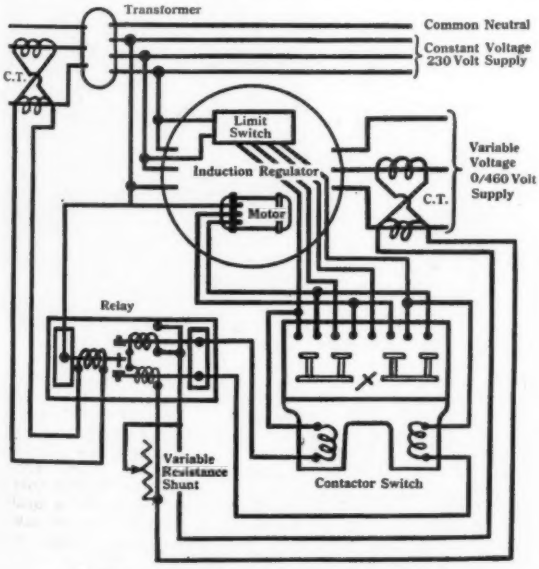


Fig. 4.—Automatic Control Circuit.

Fig. 5.—Automatic Induction Regulator.

the total load which the regulator will maintain constant may be altered in value. Therefore, if this compensating current transformer is shunted with a variable resistance the load factor may be adjusted at will.

Fig. 5 shows an automatic induction regulator for indoor installation.

In a case where a 75-kW kiosk sub-station, 6,600/400 V, is installed for the ordinary lighting and power supply, at 25 per cent. load factor, with, say, 1,200 yards of .15 sq. in. 4-core cable for a 3-phase, 4-wire distribution, the approximate cost of this, including excavating and reinstating, would probably be about £1,800. The annual cost, including the capital charges on the additional apparatus and cabling for giving a "change-circuit" supply for heat-storage and kindred purposes that would bring the load factor up to 80 per cent., is estimated at £402, and the resultant increased revenue at £500, resulting in a profit of £98; these figures are based on the sale of 360,000 units at 0.33d. per kWh.

The "change-circuit" principle is claimed to be particularly applicable to densely populated residential areas, suburban areas and garden cities, where the number of "all-electric" houses and electrically equipped flats may be expected to increase more and more. Domestic-heat supply, however, is by no means the only application of the "change-circuit." Numerous industries employ heat processes where thermal storage would provide a night load; hotels and laundry services, fermentation processes and food preparation are a few of the many possible applications.

The Physical Society's Exhibition.

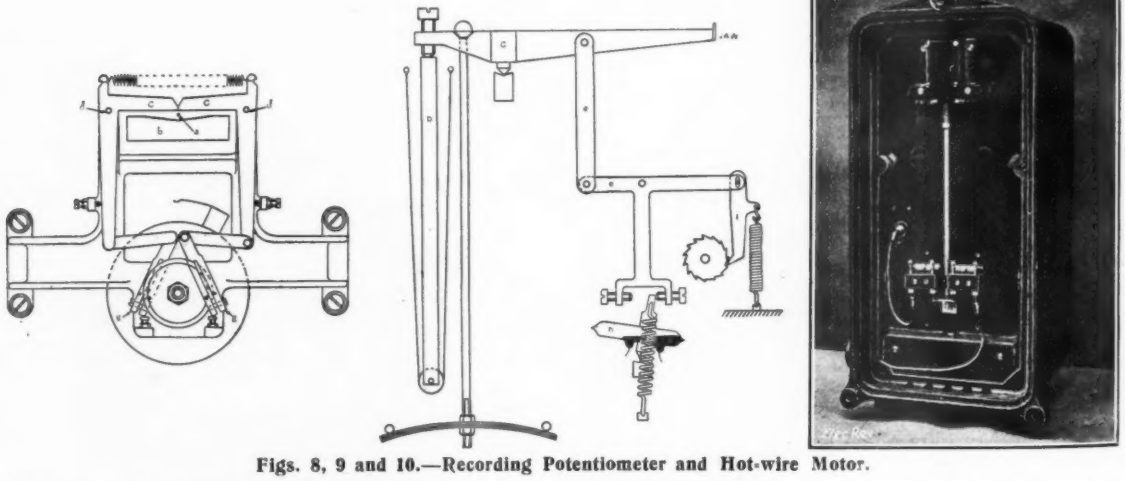
Annual Display of Electrical Instruments and Scientific Apparatus.

(Continued from page 128).

Cambridge Instrument Co., Ltd.

This display included a large selection of new instruments; for instance, in the case of a recording potentiometer, the galvanometer in series with the e.m.f. to be measured (for example, a thermocouple) is a mechanical relay whose deflection sets in motion mechanism which moves the contact on the slidewire in a direction which reduces the deflection; thus the circuit is always maintained in balance and the position of the contact along the slidewire is a measure of the unknown electromotive force. The galvanometer is of the moving coil type and has a long pointer with a cylindrical tip (*a*, fig. 8) that swings horizontally above a horizontal metal jaw (*b*) which is raised periodically, and below the horizontal members (*cc'*) of two bell-crank levers pivoted on the frame casting at (*dd'*). When the circuit is out of balance the needle (*a*) is clamped by the lower jaw (*b*) against one of the upper horizontal members, so causing the corresponding lever to tilt; this motion operates a clutch (*gg'*) which results ultimately in the movement of a contact round a circular slide wire and in the corresponding movement of a pulley carrying a cord to which is attached the pen moving on a horizontal rod, so that the rotation is translated into linear motion across the recorder chart. A novel feature is the fact that the power required to raise the lower jaw and to wind the clock for the recorder chart, is furnished by a hot-wire motor in the back of the case (fig. 10); it may be energised from any a.c. or d.c. lighting or power circuit, up to voltages of 400. The wire is wound on a series of pulleys, the upper being fixed, while the lower frame is free to move and carries a vertical push rod (*b*, fig. 9) which bears against one end of a horizontal lever (*c*), the other end of which forms the lower jaw of the galvanometer relay mechanism. A spring maintains the lever in contact with the vertical push rod, and keeps the hot wire taut, also actuating through (*e*) a tilting mercury switch (*h*) and a spring-controlled ratchet (*i*) which winds the clock for the recorder chart. When a current passing through them expands the hot wires the push rod moves downwards and the consequent movement of the horizontal lever raises the lower jaw against the galvanometer pointer, and at the same time causes the mercury switch to tilt, thus breaking the circuit. Owing to the extremely low speed of the operations (normally 8 times per minute), wear and tear are reduced to a minimum without any of the parts requiring lubrication.

The new visual oscillograph was on view which should be of considerable use in power stations, whilst a high-voltage outfit was loaned for exhibition purposes by Messrs. Callender's Cable & Construction Co., Ltd., who have used it for working pressures up to 75,000 V; it is more compact than the original Duddell pattern and possesses novel features (fig. 11). Simultaneous records are obtained from three vibrators, two of which, A, B, are electromagnetic, while one, C, is electrostatic; each is mounted in a separate oil bath placed in the gap between the pole pieces of a permanent magnet, and provision is made for adjusting the position of the vibrator and for levelling. A lens is recessed into the oil bath as near as possible to the mirror. The electrostatic vibrator (a modification of Prof. Ho's original design) is connected in series with two fixed-plate condensers of the type shown on the right of fig. 11, which reduce the pressure to a suitable value at the oscillograph terminals. The two vibrating strips are insulated from one another and charged to a definite potential difference by the battery N, the electrical centre of which is connected to a point between two condensers C_1 and C_2 in series between the terminals of the oscillograph, thus making the potential of the strips definite in relation to the field plates; C_1 has fixed plates (capacity 0.0001 microfarad in oil) while C_2 has adjustable plates (capacity 0.0012 microfarad in oil), enabling an exact electrical balance to be obtained. The natural periodic time of both types of vibrator is about 0.0003 second when undamped, that is, without oil in the damping chamber; when damped, the deflection produced at a scale distance of 60 centimetres is, on the electromagnetic vibrator, 2 centimetres for a direct current of 60 milliamperes, while with the electrostatic vibrator an amplitude of vibration (*i.e.*, the amplitude of the half-wave) of about 6.2 millimetres per 1,000 volts is obtained with a potential of 400 volts d.c. between the strips. The three vibrators in their oil baths are side by side and their mirrors are illuminated by a 6-volt metal-filament lamp to which a greatly abnormal voltage is applied for a fraction of a second during the time of exposure; the intense light thus obtained passes through an optical system which ensures that a separate beam is focused on each vibrating mirror. The reflected beams pass through a cylindrical lens, thereby reducing the images to bright spots on the photographic film, which is traversed in a vertical plane at right angles to the plane of the vibrating beams. When the camera shutter is closed, the three spots of light so formed are reflected from the back of the shutter and pass through a semi-transparent celluloid screen to hexagonal viewing mirrors which are rotated about a horizontal axis in the



Figs. 8, 9 and 10.—Recording Potentiometer and Hot-wire Motor.

initial plane of vibration of the beams, enabling the wave-form to be seen through the aperture M; a zero mirror illuminated by the centre beam provides a datum line for both visual and photographic observations. A simple drum camera P is rotated by a d.c. motor R so that the film speed may be varied from about 40 to 600 centimetres per second; the shutter may be set to expose the whole length of film in one, two, or four exposures. A mechanical device ensures that the interval of time which elapses between the extra voltage being applied to the lamp and the camera shutter being opened enables the lamp to reach its maximum brilliancy before a record is taken. For investigations lasting a considerable time, the drum camera may be replaced by a kinematograph camera, the source of light being then an arc lamp. The vibrators are insulated from one another and from the rest of the apparatus by glass plates.

The low-pressure Schering bridge (fig. 12) is a simple and accurate means of commercially measuring the power factor and dielectric constant (permittivity) of insulating materials at audio frequency. Provision is made for measuring p.f. from 0.001 to 0.5 with test capacities varying from 60 to 1,000 micro-microfarads; the electrodes and leads are so screened that samples may be readily tested at a controlled temperature and humidity; the bridge is direct reading and easy to operate; samples may be tested at the rate of about 40 to 50 per hour. The material to be tested is made up into a condenser by plac-

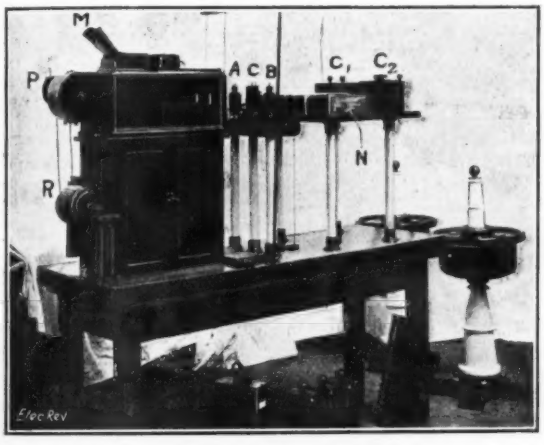


Fig. 11.—High-voltage Oscillograph.

ing pieces of the sample on either side of a guarded central electrode and enclosing the whole between two circular flat plates of metal. The guard ring and the screen of the lead from the central electrode are connected to earth; C_1 is the test condenser; C_2 a calibrated low-loss variable condenser; C_3 a small uncalibrated variable condenser, maximum capacity approximately 250 micro-microfarads: C_4 a variable condenser, maximum capacity approximately 1,100 micro-microfarads, calibated directly in power factor at 800 cycles per second; R_3 and R_4 are equal low-inductance high-resistances, and T is a high-resistance telephone. The two metal plates of C_1 are connected to the non-earthed side of the source, and it can easily be shown that the power factor of $C_1 = \tan\theta = R_4C_4 - \omega R_3C_3 = \omega R(C_4 - C_3)$, where $\omega = 2\pi$ times frequency of source and $R_4 = R_3 = R$. If the frequency of the source is kept constant, ω is constant; if R is chosen so that ω R is equal to some constant

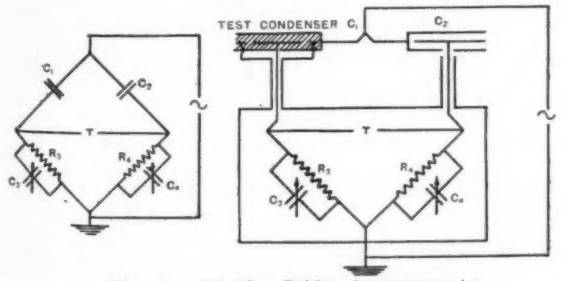


Fig. 12.—Schering Bridge Arrangement.

K, then $\tan\theta = K(C_4 - C_3)$. If the scale of C_4 is calibrated in micro-microfarads to read the difference from some small fixed value it is possible to correct for stray capacities across R_3 and R, by a preliminary balance with a no-loss condenser in the place of C_1 and adjustment of C_3, keeping C_4 on the zero of its scale. On replacing the no-loss condenser by the test condenser and balancing by adjustment of C_2 and C_4 the power factor = $\tan\theta = K$ (reading on C_4). The test condenser is so designed that the effect of stray capacities is eliminated and the preliminary balance serves to determine the capacity of the test condenser with air dielectric. The guard ring is provided with three equally spaced projections and six small blocks of the sample, representative of the thickness of the whole, are used to support the central electrode between the plates. This arrangement forms a loss-free condenser, since any leakage across the blocks is only a shunt on the source; also, if C_2' be the reading on C_2 for the preliminary balance (*i.e.*, the capacity of the test condenser with air dielectric) and if C_2'' be the reading of C_2 in the test balance, then the permittivity of the sample = C_2''/C_2'.

For satisfactory operation a source of supply is required of good wave form, known frequency, and the voltage should be fairly high. The Cambridge fixed-frequency oscillator with a high-voltage output transformer meets these requirements. The output is taken from a second valve so that the frequency is unaffected by the load and the frequency is fixed at 5,000 radians per second (800 periods per second) at which the bridge is direct reading and will remain constant within 1 per cent. under normal operating conditions.

H. W. Sullivan, Ltd.

In this large display was a self-contained bridge for the determination of power factor and capacity of solid dielectric specimens, designed in conjunction with the British Electrical and Allied Industries Research Association for rapid factory testing. The Schering arrangement is employed, the supply being purely sinusoidal and 800 cycles per second, the balance detector being a telephone receiver. The standard design is intended for measurements on samples of insulating papers and cloths, &c., having capacities from 100 to 1,000 $\mu\mu$F. and p.f. from 0.05 to 10 per cent. The various condenser scales are arranged so that a minimum of computation is needed to arrive at the p.f., the expression for which is reduced to the form $K \times C_1/C_2$, when C_1 and C_2 are the readings of the variable condenser scales, and K is a constant for the particular bridge in use.

A sub-standard wavemeter designed during the past year consists of a precision variable air condenser and associated interchangeable inductances forming a simple resonant circuit across which a thermionic voltmeter is connected for the detection of resonance; the range is 10-100 metres, the special feature being the unusually high value of capacity used in order to increase the accuracy of the instrument: thus, even at a frequency of 30,000 kilo-cycles, the capacity is not reduced below 250 $\mu\mu$F. and the logarithmic decrement not increased beyond 0.01, in order to accomplish which results the inductances of some of the lower ranges had to be of completely novel design.

The Sullivan-Griffiths variable air condenser is of the utmost precision, designed on a new principle in order to entirely overcome inaccuracies due to age and want of conformity to "law"; a number of self-screened elements are built up with the dielectric air gaps on either side of each moving plate, electrically in series and complementary, inter-capacity between adjacent moving plates being rendered negligible so that any axial movement of any moving plates, or of the moving conductor system as a whole, relative to the fixed plate system, is of no consequence. The novel design also compensates for any irregularities of movement other than that of true rotation about the axis; and this condenser should fill the gap which exists between good commercial heterodyne wavemeters having an overall accuracy of, say, 2 parts in 1,000, and the modern multivibrator standard of radio frequencies.

Stonebridge Electrical Co., Ltd.

This company's latest types of recording instruments are of the dynamometer type, suitable for a.c. or d.c. circuits, and can be supplied in the following ranges: power factor meters, frequency meters, wattmeters, voltmeters, ammeters, and temperature meters. The main features are small size, long scale, continuous roll chart, and straight hour-lines, manufactured in portable oak cases. A ferro-dynamic instrument is unaffected by a variation in frequency of ± 10 per cent. and can be used on 15-60-cycle circuits. Capillary pen mechanism is utilised and a chart speed of 2, 4, 6, or 12 cm. per hour can be provided.

Siemens Bros. & Co., Ltd.

Amongst other temperature-recording apparatus was a portable optical pyrometer outfit for use when thermo-junctions are not admissible for measuring temperatures up to 2,400 deg. C. by the observation through a telescope of brightness, compared with that of a standardised electric lamp fitted inside the telescope, the temperature of which varies with the current passed through it; this is measured by an ammeter and the corresponding temperature is read on a specially calibrated scale. Distance thermometers of various types were on view of substantial construction with indicator and selector switches combined in a single gun-metal watertight case, being operated by interlocking press buttons; the thermometers may be placed at any distance from the switchboard to which they are connected by ordinary twin cable.

Automatic & Electric Furnaces, Ltd.

The furnace exhibited was particularly suitable for all forms of heat treatment at temperatures varying from 1,000 to 1,400 deg. C., which is in excess of that obtainable with nickel-chrome resistors. Its 16 by 6 by 7-in. chamber is heated by carborundum rods fitted in the roof, the full-load consumption being 10 kW, which is reduced to 6.6 kW when standing still.

(To be continued.)

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Rotor-Starting Switch.

The latest product of the DUNDEE ELECTRICAL REPAIRS CO., LTD., "Guildhall Works," Erskine Street, Dundee, is the "Indestructible" rotor-starting switch, which, it is claimed, successfully eliminates pitting and burning of the contacts. The principle is practically the same as that described in the ELECTRICAL REVIEW, June 24th, 1927, p. 1040, in connection with the makers' pillar-type apparatus. The leading or "shorting" brushes are actuated by means of cams so placed on the switch base as to raise the auxiliary arm when the brush passes from one contact to the next. The resistance wire is wound on heavy hollow porcelain insulators, and the units are easily removable. The resistances are immersed in oil. Fig. 1 shows a rotor starter with the tank removed.

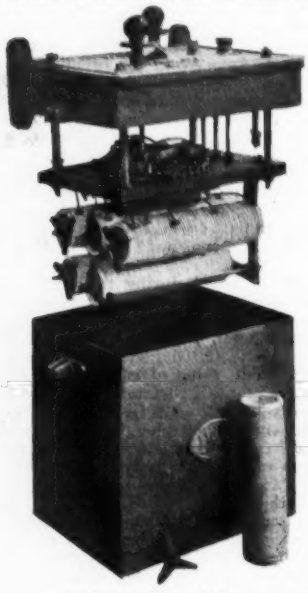


Fig. 1.—Non-pitting Starting Switch.

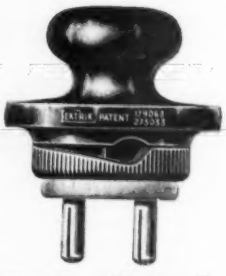


Fig. 2.—The "Minimax" Plug.

Two New "Lektrik" Products.

Messrs. A. P. LUNDBERG & SONS, 477 to 489, Liverpool Road, Holloway, N.17, have recently introduced a new pattern of "pear" switch. It is available in either single- or two-way forms, both of which are fitted with easy-action quick-make and -break switch movements. The cases are very neat and distinctive, and are available in two varieties of moulded material, "Cocusite" (brown) and "Albo" (white). By the addition of a third terminal the single-way model may be conveniently employed as a "switch-in-line." A useful feature is that the base may be adapted for use at the foot of a table standard, either arranged for push-bar actuation, as usual, or for a push-and-pull operation at one side.

Another addition to the makers "Lektrik" products is the "Minimax" plug, fig. 2. It embodies a means of overcoming the long-standing difficulty of providing the necessary "cord-grip" feature for the varying diameters of twisted, braided, c.t.s. and other types of flexible wires that are commonly used for plugs. An adjustable grip is provided at the cable entrance by virtue of the sloping notch in the knurled adjustable ring which is revolvable on the body of the plug. The gripping surfaces of both the ring and the plug are finely corrugated. By tightening up the disk carrying the plugs and connections the ring becomes fixed rigidly in position. The body of the device is also of moulded "Cocusite." The plug can be supplied with or without the hand shield and will shortly be available with two or three pins for varying capacities.

A "Universal" Floor Polisher.

An addition to the wide range of "Universal" electrical domestic appliances of Messrs. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, W.C.2, is a floor polisher. It is equipped with a tough tampico bristle brush, 4½ in. in diameter, which revolves on grease-lubricated bearings. The motor is supported by a felt roller which, it is claimed, makes it easy to guide the polisher and prevent marring of the floor. The driving medium consists of two woven belts held under tension by a spring which assures positive driving at all times. The brush and motor are held in a pressed-steel frame designed to withstand hard usage. A conveniently placed toggle switch provides easy control for the motor. The handle has the pistol-grip feature, and is finished in Japan-black. The total weight is 17 lb. when packed, with 1 lb. of paste wax and 1 lb. of liquid wax. The waxes are supplied by the company especially for use with the "Universal" machine. A 25-ft. length of connecting cord is supplied with each polisher.

A Flameproof Interlocking Switch-Plug.

A recent and interesting production of the WALSALL HARDWARE MANUFACTURING CO., LTD., Ablewell Street, Walsall, is the mining-pattern flameproof interlocking switch-plug depicted in fig. 3. It is constructed in a very robust crucible-cast case, and its two sections, cover and box, are secured together by means of special sunk-type pins which cannot be withdrawn without the proper key. The extended flanges of the cover and box fully comply, it is claimed, with the Regulations governing the use of switchgear in situations where explosive gases are present. Special asbestos-packed glands are provided for the cable leads, and are enclosed in an entirely separate chamber which is drilled and tapped for conduit connection. The makers' standard shooting-bar action is employed for the interlocking, rendering it impossible to withdraw the plug on "live circuit." The interlocking is effected by the switch handle. The switch has a quick-make and -break action and is equipped with a permanent earthing device. The plug and socket are constructed of non-hygroscopic insulating material with solid-rod protected terminals and earthing pin. The apparatus is available in two sizes, 5 A and 15 A, for both s.p. and d.p. types. A typical example of the switch-plug satisfactorily passed the standard flame-proof test of the Sheffield University Mining Department.

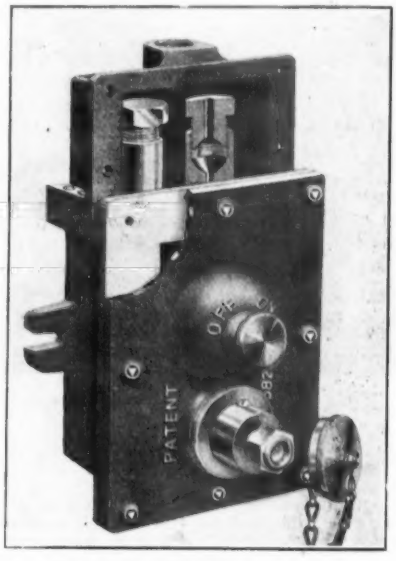


Fig. 3.—Mining-type Switch Plug.

Reflector Fittings.

In our issue of December 16th, 1927, we described a range of reflector fittings recently introduced by Messrs. PHILIPS LAMPS, LTD., Philips House, 145, Charing Cross Road, W.C.2. We learn now that a new simple sliding scale system for the adjustment of the lamp and holder has been introduced for the AK, AG and ND fittings, which is claimed to be a great improvement upon the old method of adjustment by set screws. No special adjustment is provided for the type NR fitting, as the lamp is mounted in such a way that the difference between the light-centre lengths of the various lamps used is so small as to render it unnecessary.

A Severe Lamp Test.

The headlamp of the motor-cycle used by Flight-Sergt. S. W. Sparkes for his recent successful world tour was fitted with a "Mazda" bulb. Although the journey of 12,000 miles included some of the roughest roads in the world, the bulb originally fitted survived the ordeal in good order.

Large Electric Baking Ovens.

Existing types of flame-heated ovens are described as a necessary introduction to the successful application of electric ovens, which involves a thorough understanding of bread- and cake-baking principles; British, American, and Continental ovens are surveyed and operating costs, including the average maximum demand of over 100 installations, are quoted.

By W. ELLERD-STYLES, M.I.E.E.

(Extracts from Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

WHILST considerable progress is manifest so far as small electric baking ovens are concerned, little or no headway is recorded with the larger electric baking ovens in Great Britain, whereas in the United States, France, Canada and Switzerland steady advancement may be noted. This is mainly due to the present high rates charged by electricity supply undertakings, which have a very large group of consumers at their disposal immediately an economic rate is fixed for users of large electric baking ovens essentially intended for bakers and confectioners. On the basis of 1 kWh per 10 lb. of bread (average), assuming that all bakeries had adopted electric baking, the annual total of 1,473 million kWh would be reached. The gradual change-over will be a slow process, but the possibilities are obvious.

Dr. Dorée and Mr. Kirkland, of the National School of Bakery, carried out tests to determine how far the temperature, as indicated on the oven thermometer, may be a safe guide as to the baking capability of the oven at different parts, and their conclusions . . . "show beyond doubt that whatever preconceived ideas bakers may have about the uniform heat in modern ovens, they are not well founded any more than in older types. Some of the ovens were tested at baking temperature, some considerably colder, but that did not appear to reduce seriously the variations at different parts of the oven. To oven builders absolute uniformity is probably an impossible ideal." Ordinary thermometers as fitted to ovens cannot therefore be relied upon to give the exact temperature as they are exposed to both convection and radiant heat, the latter seriously affecting the readings, as in one position the thermometer may be shielded and in another directly exposed to radiant heat. No baker's oven is required to exceed a temperature of 500 deg. F. Electric bakers' ovens probably have a better load factor than the average industrial load and operate at practically unity power factor. Most baking is performed during off-peak hours, thereby improving the load factor. No fuel-oven service equals that rendered by an electric baking oven, and slightly increased heating costs are more than offset by the efficiency, due to saving of floor space, to the labour saved owing to the elimination of dirt, ashes and cleaning of flues, and to the ease of control and saving on ingredients. The baker is as ignorant of British thermal units as the average power salesman is about bread fermentation. We must talk in terms of efficiency: it is no exaggeration to claim 90 per cent. efficiency for the electric baking oven, as it is more adaptable to high efficiency than most electrically-heated appliances.

When ample space is available the travelling type is absolutely the best of all types, provision being made for charging at one end and discharging at the other end, and it is essential to completely automatic plant; rapid strides have been made in this direction in the United States, an excellent example being the Rainier oven (fig. 1).

They are substantially built of brick having high heat-storage capacity and high thermal efficiency, or of metal with insulation between the baking chambers and between the inner and outer walls. The former require preheating over a longer period, but are economical when baking, whilst the latter speedily reach baking heat, but require current during baking operations to maintain the required temperature.

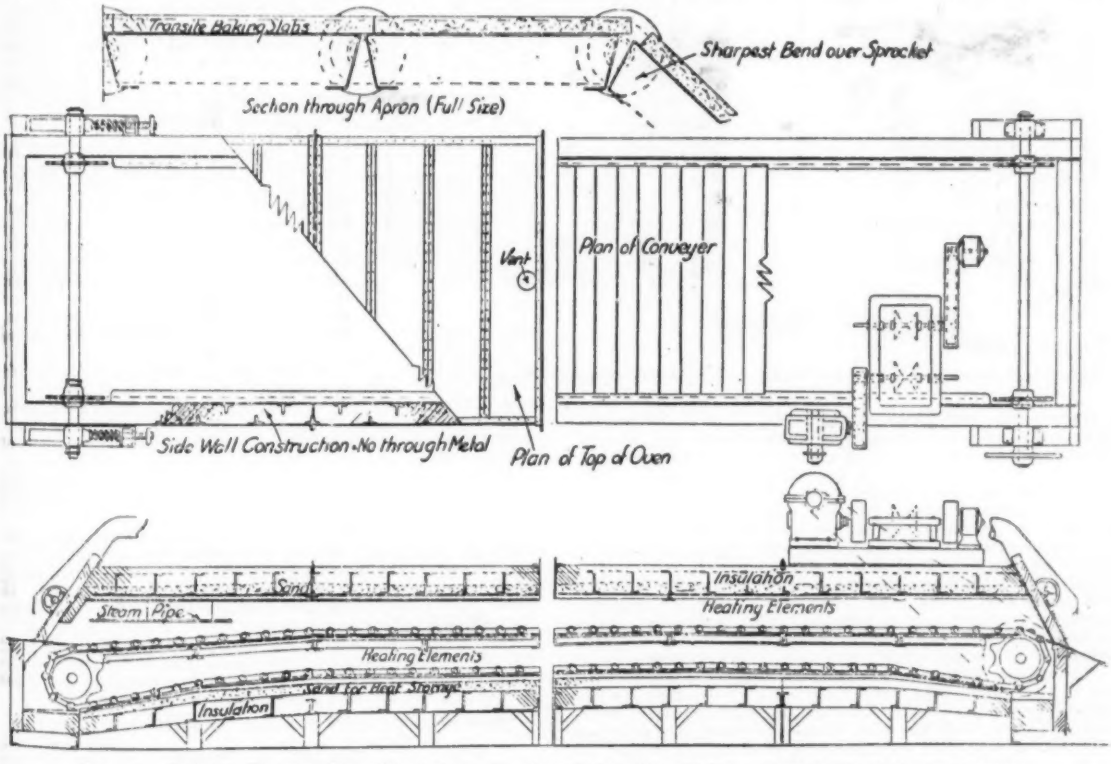


Fig. 1.—Rainier Electric Travelling Oven in Salt Lake City, U.S.A.; 3,000-loaf, 60 ft. in length.

Metal-built ovens are portable, or semi-portable, and are tenants' fixtures; both types possess accurate temperature control, permitting normal dough expansion and ensuring that the finished break has an even colour; both can be provided with steam ejectors (generators), which are essential to produce the crisp crust on the loaf. The brick-built oven has the advantage when considered as a night load, for it has higher heat-storage capacity (fig. 2).

In Switzerland such an oven will only be used during each day, from six to seven hours being required to bring it up to the normal baking temperature of from 450 to 500 deg. F. At 10 p.m. the full heat is switched on and at 5 a.m., before baking the first batch, it is switched off; normally the oven is not heated during the day, but it is left about 30 minutes before the second batch is introduced; in the meantime the stored heat brings the oven up to the normal temperature, which drops after baking the first batch; two, three, or four batches of bread can be baked, and in the afternoon cakes and pastries.

An oven 2.25 m. by 3.8 m. has a baking surface of 8.55 m²., and a loading of 5 kW per m². of baking surface bakes 18 kg.

of bread per m³. For a two-deck oven of this size the maximum loading would be 85 kW and the production of bread in three batches 870 kg. Each oven is daily brought up to 240 deg. C., and the temperature in the evening should not be lower than 150 deg. C. if the insulation is well located.

When comparing the weight of bread (Continental) baked per foot of baking surface with American and English equivalents, it must be noted that Continental bread is usually flat and spreads over the surface in shallow form, whereas the English and American practice is to pack the bread closely (frequently in tins) so that the loaves are higher and, weight for weight, occupy less baking surface.

No flues have to be constructed other than a vent to regulate the steam condition of the baking chambers. Provision must be made for the heating elements to be located under the sole and above the crown of the oven. The practice of placing the elements in the baking chamber direct has the disadvantage of creating "flash heat," and the baffle plates and similar devices sometimes used to shield the goods in the oven can only be looked upon as a compromise. It is most desirable that provision be made for readily withdrawing the elements for inspection: access is best provided from the oven front, as in a number of establishments it may not be possible

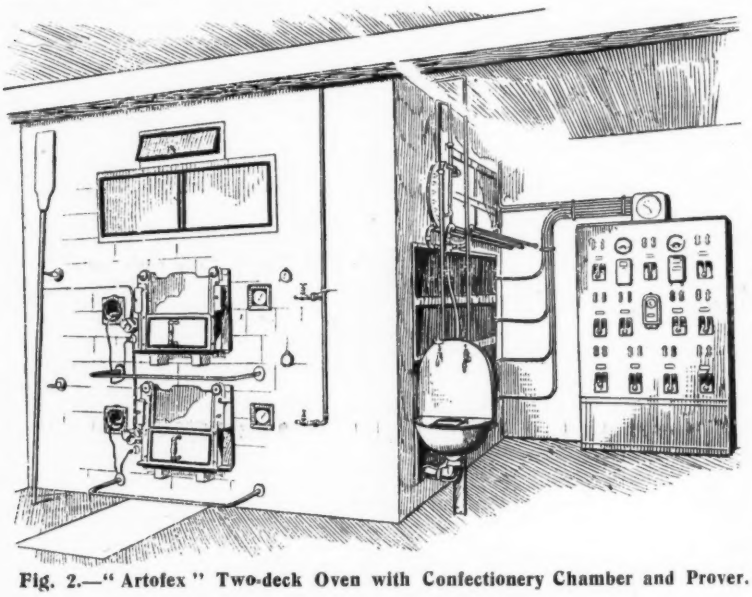


Fig. 2.—"Artofex" Two-deck Oven with Confectionery Chamber and Prover.

to arrange side access; from the point of view of constructional convenience side access is most desirable, seeing that shorter elements can be designed which are more readily handled than elements extending from back to front of the oven.

When circumstances compel restricted hours of supply, or when the period during which low rates are available is insufficient to permit of the unrestricted use of the oven, it may be necessary to devise means whereby no handicap is placed on the output of the establishment where the oven is installed. Such provisions would also overcome the difficulty that would arise in the event of the supply not being available through breakdown, or strikes, &c. This possibility cannot be too forcibly stressed. Several methods have been adopted, one of which is the subject of a patent* which combines in a steam-pipe oven electric heating elements below the steam pipes under the baking chamber sole and above the steam pipes in the crown of the baking chamber; it is therefore possible to heat the oven electrically when low rates are available, and at other periods to continue baking with solid or liquid fuel.

All-metal travelling ovens are giving commendable results in the United States, some having a baking conveyor 98 in. wide and up to 80 ft. in length. The Rainier oven, for instance, is built with a conveyor consisting of steel pans on which are mounted composition tiles; they can be used for baking bottom bread, have full thermostatic control, and are wired to 6 watts per square inch, two-fifths being in the upper element and three-fifths in the lower element. The consumption per pound of bread baked averages 80 watt-hours.

Reel ovens are peculiar to the United States. The reel carrying the swinging trays is worm-driven direct on to the centre shaft. Firing is arranged at the base of the oven, which is the practice followed with the electric conveyor oven; the entire baking chamber has to be heated, and accordingly the efficiency per square foot of baking surface is of a low order. Two of these ovens are working in the shredded wheat factory at Welwyn Garden City. A modification of an American reel oven has been marketed in this country by the Metropolitan-Vickers Electrical Co., Ltd.†

Draw-plate ovens must be carefully designed owing to the unavoidable cooling-off of the plate when withdrawn from the baking chamber on rails attached to an undercarriage. The "Magnet" draw-plate oven‡ is a good example of this type, and has been built in sizes up to 2½ sacks (equivalent to 1,000 lb. of dough). This size would have a maximum loading of 56 kW, or 0.53 kW per sq. ft. of baking surface. One conspicuous feature demonstrated with such an oven recently was that batches of bread are baked in from 10 to 15 minutes less time than with the coke-fired oven.

In 1924 a method of heating steam-pipe ovens electrically formed the subject matter of an English patent‖ whereby electrically-heated chambers are provided into which the lower (back) end of the steam-pipes project, exactly as in fuel-fired ovens

Taking an average from over 4,000 electric bakery installations varying from 300 to 14,000 loaves daily output, the average power consumption is 90 watts per pound of bread baked. A typical bakery with two ovens, having a total connected load of 41 kW, has a daily output of 4,000 lb. of bread and a monthly consumption of 3,500 kWh. One bakery in which tests were made had a monthly production of 3,000 cakes and 24,000 loaves of bread. Both gas and electric equipment were used for comparison. An average saving of 5 to 6 oz. per cake, or a total of 156¼ lb., was made by the electric oven. The bread savings totalled 150 lb. A simple calculation reveals the equivalent savings in cash. It was further found that the gas-baked cakes shrunk 5 oz. each more than the electrically-baked cakes in a period of 5 hours after baking. In another instance a bakery claims a saving of ¼ to ¾ oz. per pound of bread baked.

To assure maximum economy in operation the smallest possible oven should be installed that will turn out the required production in the longest number of hours during continuous operation; this will keep the maximum demand to a minimum. Assume 1½ to 3 hours to preheat the oven, according to size; after preheating it takes from 50 to 60 per cent. of the maximum load of the oven to bake the heaviest products. Assuming the oven to be efficiently insulated, considerable heat is retained long after the current has been switched off. It can be accepted that a good oven has an hourly capacity of 1½ times its deck capacity for bread baking, and twice the deck capacity hourly for rolls and buns, the hourly pastry capacity depending upon the variety.

If it is conceded that the lighting load determines the peak load of the system on certain traction and industrial loads, a baking load can be arranged to fill in the valleys by establishing an off-peak schedule. In a considerable number of instances there should be no expenditure for service mains, and the majority of installations would be in commercial districts which would not require any additions to the existing feeders or substation transformers.

Records have established that baking-oven installations consume, on an average, 150 kWh per month for each kW of connected load. The maximum operating demand averages 50 to 60 per cent. of the connected load on the equipment. In some cases installations are consuming 200 kWh per month for each kW of connected load.

No statistics are available giving the types of ovens used and the number installed throughout Great Britain and the Irish Free State. The following schedule indicates the types and respective numbers employed in America:—

Types of Ovens in use in U.S.A. by 15,800 Establishments.

Type.	Year 1923.	Year 1925.	Approximate inc. or dec. in two yrs.
Drawplate ...	1,542	2,038	+ 32 per cent.
Peel	23,998	17,172	— 10 per cent.
Portable ...		4,405	
Reel	2,679	1,290	+ 5 per cent.
Rotary		1,298	
Sugar wafer § ...		30	
Travelling ...	363	622	+ 71 per cent.

Total ovens (1923) = 28,582.
" " (1925) = 27,055.

In 1926 the author was advised by President Ingold, of l'Association Suisse des Patrons Boulangers et Patissiers, that approximately 6,000 ovens are used in Switzerland, mainly of the brick peel type. They anticipate that 4,000 will be electrified within 15 years, involving a saving of 120,000 tons of imported coal per annum, and that 320 million kWh per annum will be required by baking ovens. In Zurich 30 per cent. of the ovens are electric. The conversion to electric heating is based on their operation during off-peak hours.

* Swiss Patent No. 90,685, January 16th, 1922.
†ELEC. REV., October 23rd, 1925, p. 644.
‡ ELEC. REV., October 23rd, 1925, p. 644.
‖ Specification No. 220,179, August 14th, 1924.
§ Sugar wafers are thin biscuits eaten with ice-cream.

Discussion in London.

Mr. F. W. PURSE explained that the subject had been studied carefully in his locality, and one was bound to agree with the author's conclusions, but bakers wanted to know not only the cost of operation, but also the cost of installing the new ovens, and he had not been able to induce them to change over. It should be remembered that a large oven could not be connected to the l.p. distribution system; for its connection to the h.p. mains a transformer would be needed and the space occupied by it should be taken into account when considering the saving in space that accompanied the adoption of electric ovens. A year ago he would have been delighted to advocate cheap electricity in support of the author's contentions, but the Electricity (Supply) Act, 1925, would not permit them to "fill in the valleys" in their load curves by offering cheap supplies. How could they offer power to bakers at ¾d. per kWh if the maximum demand was to be determined in the manner outlined in that Act? So they must go slow till they knew just where they were.

Mr. J. C. KERSLAKE (president of the National Association of Master Bakers) pointed out that the baker and engineer must get together in order that each might ascertain the other's requirements. He had been dreaming of electric ovens for the past 20 years, but it might be advisable to limit their capacity to one-half sack per oven. He believed they were on the eve of great developments in electric ovens, particularly as England was a nation of small bakers, who would benefit most by the conversion. The risk of breakdown merited serious consideration, for the failure of the supply of electricity for two hours might mean the loss of a whole night's product, because fermentation would not stop. The saving in the weight of bread achieved by electric baking mentioned in the paper might result from the use of some ovens, but it was not universal, and depended on several factors, including whether the bread was sold hot or cold. He was greatly interested in the heat storage principle, and had heard of a French electric oven which was said to have a temperature loss of only 1 deg. C. per hour. Finally, he offered any help or advice from the practical baker's aspect which electrical engineers might find themselves in need of.

Dr. T. SETTLE, speaking with knowledge of 200 ovens supplied and installed, said that rates for electricity should not be more than ¼d. per kWh for large ovens, ½d. for small ones, and 1d. for mixed installations; bakers were satisfied with those rates. There might be a tendency to compare fuel costs, but the only proper comparison was that of all-in costs. The saving in the weight of dough was quite definite, and he knew of cases in which 2-lb. 4-oz. loaves weighed the full 2 lb. two days later. He had recently visited the U.S.A., where he found that the cost of electricity was only 1.1 per cent. of the cost of the retail product. Over there they had engineers who did nothing else but push electric baking and cooking, the use of which was increasing by leaps and bounds, and the power rate decreased as the size of installation increased. It was believed that the L.C.C. intended to condemn all underground baking premises, but many such places could be enormously improved from the sanitary and other aspects by conversion to electric baking, which would render many such bakeries fit for retention in use if the Bakers' Association took the matter up. Personally, he was inclined to favour the conversion of existing ovens, but that would not be a proper manufacturing proposition. Data were needed with respect to furnace linings; there must be a "best size" of lagging for a given size of oven, but what was it? There seemed to be a superstition that oven-heating elements were liable to break down, and anyone who could dispel that fallacy would do the industry a great service. With regard to the 200 ovens he had mentioned, no replacement of elements had been called for.

Mr. P. DIENY quoted figures relative to the French heat-accumulative oven which had been mentioned. It was switched on during the night, and possibly for one or one and a-half hours at noon, when electricity cost the same as it did at night; low-temperature elements were used, and the energy consumption was 180 watts per lb. of bread baked; 960 kg. of bread could be baked during the day with a fall in temperature of only 6 deg. after each batch, the last batch being baked at 200 deg. C. It had been found possible to bake 300 kg. of bread 36 hours after the electricity supply had been switched off.

Mr. W. B. WOODHOUSE suggested that electric baking did not differ very much from any other industrial electric heating problem. Not only cost, but also cleanliness, convenience, and accuracy of control, improved quality and uniformity of appearance of the product were material factors. Electricity at ¾d. per kWh would pay, and even less than that figure was being charged at some places where they were not so despondent as Mr. Purse appeared to be.

Mr. E. KILBURN SCOTT suggested the electricity works might attempt to sell steam, as was done in America.

Capt. H. E. O. ELLIS had intended to speak, but said his remarks had been anticipated.

Mr. W. ELLERD-STYLES, in the course of his reply to the discussion, remarked that the improvement in the appearance of electrically-baked products was very marked; indeed, so much so that it had led to repeat orders for electric ovens. Research needed to be carried out to determine the reason for that result.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Electric Cooking.

The subject of an extended use of electric cooking was under consideration at our last annual electricity supply conference at Brisbane.

Mr. F. W. Clements, managing director of the Melbourne Electric Supply Co., brought to our notice extracts from the National Electric Light Association *Bulletin* under headings: "Results of Range Load Survey. Brief Analysis of 1925-1926 Report of Domestic Cooking and Water Heating Committee with Respect to Electric Ranges."

This is a very interesting report to all those who are pushing the electric cooking proposition. Summarised, the results showed an average connected load of about 7 kW per range, the diversity factor bringing the consumption down to 0.7 kW per range, with a load factor of 18.9 per cent. Mr. Clements has applied these figures to his undertaking, and others would find a similar comparison of considerable interest.

If there should be a very extended use of electric cooking, it would seem that it would so react on the load factor of supply as to make it very questionable whether this additional load was desirable or remunerative. I have always criticised electric cooking appliances as being designed on fundamentally wrong lines. I remember drawing attention to this in your paper shortly before I left England, and have repeated it since. At that time I was carrying out a number of experiments with regard to the conservation of heat for electric cooking, the principle I was working upon being the heating-up of hollow cast cylindrical blocks of copper, which would be heated electrically and continuously during the 24 hours, and would be designed to give up their heat when cooking operations were required.

I was not able through want of time to push these experiments further, but the idea, I feel sure, is capable of practical solution. I am convinced that the principle of conserving heat generated by a small kW demand, at approximately 100 per cent. load factor, will eventually be the only satisfactory solution of the cooking problem.

There is the same problem to be faced in connection with electric radiators. Here, again, the peak load from the use of radiators in Melbourne has been so excessive that tariffs have had to be materially raised with a view to endeavouring to restrain their use and create a less losing proposition.

If the enormous amount of ingenuity that has been put into cooking and heating appliances had been directed on the lines I have indicated, then electric cooking and heating would have shown to-day an enormous advancement on sound economic lines.

I again suggest that experts concentrate on the lines suggested by me.

P. J. Pringle.

Ballarat, *December 12th*, 1927.

[The principle outlined by Mr. Pringle is practised extensively in Sweden. Full particulars of the "Seves" cooking stove with heat storage were given in our issue of September 17th, 1926.—EDS. ELEC. REV.]

Installation Wiring in India.

I have just come across the letter about wiring in India signed by Mr. C. R. Palairet (ELECTRICAL REVIEW, September 23rd, 1927). Having erected many installations of all sizes during my 31 years' experience as an electrical engineer out there, I would like to make a few remarks on the subject.

As far back as 1899, I tried paper-insulated small-size wires for house-work. These were specially made by a firm which is now one of the C.M.A. group. The result was disastrous. Wires erected during the day showed good insulation at the finish of the day's work, but when tested on the following morning the insulation was nowhere. The installation was put in during the months of April and May, the driest and hottest season of the year. This shows that when using paper-insulated wire, especially as the cross section of the paper is considerable, compared with that of the wire, it is a necessity to seal the end of every wire immediately it is fixed; and unless the work was being done in the dry season, each wire would have to be artificially dried out when connected up, and then sealed immediately. How this would be done in junction boxes for the usual taps would have to be carefully considered; moreover, the amount of increase in labour cost would make the price prohibitive in these days, and put this type out of the running.

I do not agree with the writer of the letter as to the period that installations will last. I have had them last 25 years, although the depreciation I allowed was 20 years; the life of the whole installation depends on:—

(*a*) the labour;

(*b*) the quality of the rubber, which, contrary to most experience, has proved that not too good a quality of insulation should be used. 2,400-megohm wires, which I used to install in my early days, I found not to stand up to the heat and damp, as the white rubber on vertical runs used to liquefy and run out of the ends of the wires into switches and plugs in about two years.

(c) There should be no sharp bends—the rubber stretches at the bend, gets brittle and cracks with exposure to heat and damp—and no pressure should be put on the insulation, which always gets brittle and cracks, *e.g.*, where clipped under cleats: a few years are sufficient for this.

It is necessary that careful supervision shall be exercised the whole time the work is being carried out.

I do not consider Indore typical of all Mafasil India, but only of Punjaub conditions; Madras, Bombay and Bengal can give very different conditions.

Conduit is not, at least in Calcutta, too successful, since the ubiquitous white ant has, in quite a number of installations I know of, taken up its abode in the tubing, ruining the insulation and making it impossible to pull the wires out in order to replace them. Tubing systems also give trouble in the rains unless very carefully designed, owing to condensation. I might mention that the white ant has now developed a species which will eat rubber, and I have had many shorts caused by this.

Bitumen cables have not been an unqualified success for the reasons stated by Mr. Palairet, and I do not see how house wires similarly insulated could be made suitable.

During the last few years, I have had experimental wires made up for me, and have found one insulation which has proved useful in the very damp climate of Bengal.

I had had a great deal of trouble with flexibles in certain positions; they would not last more than a few months without shorting through. I am referring here to pendants, which are not handled. I tried C.T.S., which gave me slightly better results. I then gave a firm of manufacturers the details and they sent me out samples, which I tried. These had lasted two years when I left, and seemed as good as at the beginning. I cannot state how they are standing up to it at present, but this will show that the conditions can be met by rubber cables if a study of the conditions is made by the manufacturers.

It may be of interest to know that in the vulcanised flexibles I referred to above (which were 600-megohm grade), I found on examination under the microscope that the rubber had become powdery, and that there were also many bodies which looked like a transparent bacillus: whether the tropics produce a form that affects rubber I cannot say, but it might be worth investigation in this line.

Mr. Palairet refers to competition causing deterioration in cables, but doubts if the public demands cheaper cables of a lower quality. As regards the Indian, he will buy and install almost anything that looks like an insulated wire.

I have samples of flexible by me now of foreign manufacture, which, after a year in India, were absolutely useless, but the sale was very large. The public do not know any better, and the Indian contractor, from my experience, goes for the cheapest. The test made by the electrical supply company's engineer has only to show that at the moment of test the insulation of the installation is sufficient to pass the prescribed test and no more. It, of course, has to be remembered that in the tropics everything deteriorates very much more rapidly than in cooler climates, especially fibrous materials, and this no doubt affects all insulating compounds. It is well-known also that life generally in the tropics is shorter.

Battiwallah.

Sydney, *December 13th*, 1927.

The Legal Position of a Receiver and Manager.

Your correspondent (Mr. Fogarty) has, up to a point, stated the case correctly, but he has omitted one important particular. As a general rule a receiver and manager appointed by the debenture-holder of a company gets his appointment confirmed by the Court, in which case he enters into a bond equivalent to the approximate amount of money which he is likely to handle, or if the Court be otherwise satisfied it may dispense with this guarantee.

Generally speaking, there is no question that goods ordered by such a receiver and manager must be paid for.

It is perfectly true, as your correspondent states, that the legal position of a receiver and manager is that of an officer of the company, but this position, with the added responsibility of being the agent of the debenture-holder, would make his position in relation to a supplier of goods ordered by him such that I doubt whether he dare refuse payment, or could resist legal process.

Certainly never in the course of a long experience in which I have had to deal with many similar cases have I ever been refused payment, nor has the question of non-payment ever arisen, and I have yet to meet a receiver and manager, whether appointed by the Court or otherwise, who would dare to refuse payment for goods supplied to him.

Of course there may be some exceptional circumstances in an exceptional case which may excuse payment or give cause for refusal of payment, but such a case would have to be very exceptional, whereas from your correspondent's letter he would appear to regard it as the usual practice and that payment would be the exception.

My opinion is that the law does not need any alteration and that there is ample protection now afforded.

Managing Director.

London, *January 17th*, 1928.

Directional Relays.

In your issue of January 20th, on page 128, you describe a dynamometer-pattern directional relay which was exhibited by Messrs. Everett, Edgcumbe & Co. at the recent exhibition of the Physical Society. You say that the induction-pattern directional relay is less efficient than the ironclad dynamometer pattern described by you. We would like to point out that this is utterly at variance with the facts.

Taking the figures which are quoted by you, the latest type of ironclad dynamometer relay requires 0.03 VA on 10 per cent. reverse current, whereas the induction instrument as made by us, under similar conditions, only requires 0.006, a rather large difference which does not seem to indicate inefficiency.

There is a further point which you do not mention as a characteristic of the dynamometer relay, that is, what it consumes on full-load forward current. This has a very important bearing on the instrument transformers used in conjunction with it. In the case of the induction relay, the volt-amperes at full forward current, both in the current and pressure coils, do not exceed in the aggregate 5 VA. We can only assume, from the figures given above, that in the dynamometer type the VA required will be much in excess of those of the induction instrument.

There is also a final point of excellence mentioned in connection with the dynamometer relay, namely, that when it is set to operate with a 10 per cent. reversal, and the voltage falls to 2 per cent., the increased current required to work it is only 30 per cent. above full load. In the case of the induction instrument it is only 20 per cent.

As to the stability of operation, which in the case of the induction instrument (as it is a true wattmeter) is excellent and reliable, nothing is said in the case of the dynamometer relay; one can only assume that this is a case of "the least said soonest mended."

Nalder Bros. & Thompson, Ltd.

FRANK H. NALDER, *Managing Director.*

London, *January 23rd*, 1928.

Domestic Heating and the Load Factor.

There is no doubt that the severe cold snap before Christmas hit badly those undertakings that were making use of a bulk supply. There was a big and abnormal jump in the maximum demand, due entirely to consumers switching on every available heating appliance. In all probability consumers made demands which they will not repeat again for another twelve months.

The effect on the undertaker's revenue was comparatively small, but such was not the case as regards the kilowatt demand charge. As one engineer put it to me: "I am going to receive pence from my consumers for which I shall have to pay pounds to the bulk supply authority."

In your notes on Mr. Blake's letter, you suggest that too much weight should not be attached to such occurrences. I quite agree, if one is running one's own plant; but if one is taking a bulk supply, the maximum-demand indicator is not going to show any mercy. It will certainly cope adequately with the passing emergency, but not in a way satisfactory to the undertaking.

With the probability that most undertakings will in the near future be taking a bulk supply, if not for their whole requirements, at any rate for part of them, the problem will become acute, and those undertakings which are supplying heating units at a very low rate will find it difficult to justify such rates as sound under the new conditions.

Years ago a great many undertakings supplied power, and to some extent heating, on a two-rate (day and night) tariff. My undertaking, for instance, in pre-war days charged for power 4d. per unit between sunset and 8 p.m., and 1½d. at all other times. The system was discontinued partly owing to the cost of metering, the tariff requiring, of course, an instrument with two counting trains and a time switch. It seems to me, however, that the time is coming when this type of two-rate tariff will come into its own again, and incidentally, it may have the effect of reducing the number of tariffs in force, as there is no inherent reason why a single two-rate tariff should not be introduced which could apply to all supplies, lighting, power, and heating.

The contract or "Telephone" system of charging, as at present worked, hardly meets the case, as most undertakings, in arriving at the fixed charge, ignore the load due to heating appliances. An addition could, of course, be made to the fixed charge to cover such demand, but if the figure were adequate, the total fixed charge would probably so alarm the consumer that he would not sign up.

M. Farrer.

Twickenham, *January 16th*, 1928.

What is a Trade Buyer?

With reference to your leading article on this subject, a trade buyer is one who makes purchases for his particular branch of industry, but apparently a buyer of electrical goods need not be attached to any particular trade.

The difference can be likened to a stepfather; he is the husband of a widow, but not the father of the child. The electrical industry cannot afford to keep other people's children.

One hundred years ago Michael Faraday made public a new process, which a manufacturer adopted to his profit. He was not entirely ungrateful, he sent Faraday a few pairs of razors

| | | |

February 20th to March 2nd, 1928. Open Daily, 10 a.m. to 6 p.m.

THE LORD MAYOR,
PRESIDENT AND COUNCIL OF
THE

BRITISH INDUSTRIES FAIR

(BIRMINGHAM),
invite the attendance of

This invitation must only be used by the accredited representative of the firm to whom it is issued, and it is not transferable.

It must be signed by the user before entrance.

The person using this ticket may be required to sign the Attendance Book at the entrance.

Signature of user.....

TO BE GIVEN UP AT ENTRANCE.

Children under 14 years of age not admitted. *Goods scheduled for exhibition are listed overleaf.*

Admission without this ticket 2/-

This invitation is also available for the London Section (White City), which will be held during the above dates, and will admit any Trade Buyers accompanying the holder.

TRAIN SERVICE (WEEK-DAYS).
Between BIRMINGHAM (New Street) and CASTLE BROMWICH during the Fair.

B'ham	C. Brom.	B'ham	C. Brom.	C. Brom.	B'ham	C. Brom.	B'ham
a.m.	a.m.	p.m.	p.m.	a.m.	a.m.	p.m.	p.m.
7 24	7 36	12 15	12 26	7 31	7 48	3 6	3 21
7 30	7 41	1 5	1 18	7 39	7 55	4 30	4 40
7 38	7 51	1 12	1 25	8 0	8 18	4 54	5 10
7 45	7 58	1 17	1 32	8 18	8 37	5 43	5 58
8 15	8 27	2 5	2 16	8 45	9 0	5 50	6 2
8 28	8 39	2 34	2 45	9 32	9 47	6 8	6 16
8 45	8 56	3 12	3 24	9 54	10 10	6 20	6 35
9 45	9 57	3 30	3 46	10 39	10 53	6 32	6 42
10 35	10 49	4 6	4 18	10 51	11 7	7 6	7 21
10 50	11 3	4 35	4 50	p.m.	p.m.	8 18	8 35
11 20	11 31	5 35	5 47	12 30	12 47	8 34	8 49
		6 0	6 18	1 53	2 7	9 2	9 17

MOTOR BUS.
[illegible] CHAMBER OF COMMERCE (New Street) and CASTLE BROMWICH every 15 minutes

ELECTRICAL REVIEW SUPPLEMENT. *January 27th,* 1928

BRITISH INDUSTRIES FAIR, 1928

London & Birmingham, 20th February to 2nd March.

Outward Journey to *Birmingham/London (*Not available before 18th February, 1928*)

To the Booking Clerk.....*Station*.....*Railway Company*

Please issue to holder who is travelling to the British Industries Fair a†.....Class single ticket to *BIRMINGHAM/LONDON upon payment of the Ordinary Single Fare at the time of booking (Minimum 1/-), and presentation of Card of Invitation with this portion intact.

* *Strike out Birmingham or London as the case may be.*
† *Insert Class.*

To be stamped here with name Stamp of original starting station.	Stamp of Fair Authorities.

INSTRUCTIONS.

(a) *Trade Buyers who visit one Fair.*

Trade Buyers who visit one Fair only can obtain a ticket for the return journey, by the same route as they travelled on the outward journey, at one-third of the Ordinary Single Fare (fractions of 3d. reckoned as 3d.) on surrender of the voucher on the back of this Card.

Before the concession can be granted it is essential that this portion be stamped by the Booking Clerk at the original starting station and at the special office in the Fair Buildings, otherwise the Ordinary Fare will be charged on the return journey and no refund made in respect thereof.

(b) *Trade Buyers who visit both Fairs.*

Trade Buyers who visit both Sections of the Fair (i.e., both Birmingham and London) can obtain a Railway ticket between the first Fair visited and the second Fair at two-thirds of the Ordinary Single Fare (fractions of 3d. reckoned as 3d.) on production of this Card duly stamped and the surrender of a special voucher issued by the Secretary of the Fair.

A ticket can also be obtained from the second Fair visited (either Birmingham or London as the case may be) to the starting town by any recognised route at two-thirds of the Ordinary Single Fare (fractions of 3d. reckoned as 3d.) on surrender of the voucher on the back of this Card.

X Unless this portion of the Invitation Card is stamped in the space ABOVE by the Booking Clerk at the original starting station as well as by the Fair Authorities at the first Fair visited, and is also stamped in the space BELOW by the Booking Clerk at the Station (either at London or Birmingham) from which the ticket was taken to the second Fair and by the Fair Authorities at the latter Fair, the ordinary fare will be charged on the return journey and no refund made in respect thereof. X

To be stamped here with name Stamp of Departure station (either in Birmingham or London) when starting journey to the second Fair.	Stamp of Fair Authorities at Second Fair visited.

BRITISH INDUSTRIES FAIR, 1928

London & Birmingham, 20th February to 2nd March.

Return Journey from *Birmingham/London (*Not available after 3rd March, 1928.*)

To the
Booking Clerk.....Station.....Railway.

(a) For Trade Buyers who have visited one Fair only.

Please issue to the undersigned a†.....Class single ticket to‡.....at one-third of the Ordinary Single Fare (fractions of 3d. reckoned as 3d.) on surrender at the time of booking of this portion of Invitation Card duly stamped on the other side with the Station name Stamp of original starting station, and by the Fair Authorities.

Passengers must travel on the return journey by the same Company's route as on the outward journey.

* *Strike out Birmingham or London as the case may be.*
† *Insert Class.*
‡ *Insert name of original starting station.*

NO. OF TICKET ISSUED AND FARE.
(To be filled in by Booking Clerk.)

No.	Fare.

(b) For Trade Buyers who have visited both Fairs.

Please issue to the undersigned a*.....Class single ticket to†.....by any recognised route at two-thirds of the Ordinary Single Fare (fractions of 3d. reckoned as 3d.) on surrender at the time of booking of this portion of the Invitation Card duly stamped on the other side with the Station name Stamp of original starting Station and by the Fair Authorities of the first Fair visited, also with the Station name stamp of the Station (in Birmingham or London) from which a ticket was taken to visit the second Fair, and by the Fair Authorities at the latter Fair.

* *Insert Class.*
† *Insert name of original starting TOWN.*

NO. OF TICKET ISSUED AND FARE.
(To be filled in by Booking Clerk.)

No.	Fare.

This portion of Invitation Card to be surrendered to the Booking Clerk at the time of Booking for the return journey.

Schedule of Exhibits at Birmingham.

Brassfoundry, Hardware and Ironmongery.

Engineering and Machinery: Foundry Appliances.

Power, Lighting Heating and Cooking Plant.

Motor Cycles, Cycles and Motor Accessories.

Mining, Colliery, and Quarrying Plant.

Construction, Building and Decoration.

Brewing, Distilling and Catering Plant.

Railway and Municipal Plant.

Metals of all descriptions (Excluding Precious Metals).

Guns and Ammunition.

Agricultural and Horticultural Machinery and Appliances.

For particulars of train service to and from Castle Bromwich see over.

Fam.

No.

to give away, but though pleased with the "compliment" Faraday did not even think of keeping a razor for himself.

Consider a few points:—

(1) An electrician in a motor-car shop buys a spot light fitted with an Osram lamp. . . . Trade terms refused. Why? An electrician is not a motor-dealer.

(2) An electrician in a large store passes from the electrical department to buy a wash-bowl to replace one broken by his men. Trade terms refused. Why? An electrician is not a plumber.

(3) Reverse the order of things and let the motor-man and the plumber invade the electrical department! They are not refused: trade terms are thrown at them. Why?

(4) Wireless, domestic telephones, and private house plants, are passing out of the hands of the legitimate trade. Why?

In a well-known paper the following appears:—

"We notice, however, that the highbrow electricians still refuse to look upon wireless as a branch of the electrical industry."

(5) The lowest tender and no qualification, registration, association, or organisation, aids a *bonâ-fide* contractor to obtain a public contract. "?"

(6) The question therefore is: how can the contracting industry demand fair or similar treatment?

(7) Some defend by hitting back—by plain speaking, by calling a spade a spade. Unhappily, too, some believe that no reform can be achieved without the aid of floods, storms, or other forms of violence!

(8) Having tried many expedients and found the motto "Ourselves Alone" an obsolete one, there is the supreme lesson of the 20th century that we are interdependent! Why not co-operate with these favoured trades and learn from their methods how to acquire the respect the contracting industry lacks?

Manchester, *January 22nd*, 1928. **L. E. Wilson.**

A Rental Prepayment Meter

Referring to the letter in your current issue regarding the above, and the difficulty remarked, we would point out that the fixed-charge collector manufactured by us, and advertised in the current issue, is a separate prepayment device which can be used in addition to any ordinary prepayment meter for the purpose of collecting the rental charge, and can be used for either a.c. or d.c. supply circuits.

There is a general opinion amongst meter engineers that the separate instrument is the better solution of the problem, as giving a greater flexibility, also for other reasons which can be appreciated by all who have had practical experience with prepayment meters.

Regarding the question of cost, it will be noted that the combined cost of a good prepayment meter and the "Utility" fixed-charge collector (both of British make) is less than the price of the dual-duty piece of apparatus mentioned by your correspondent.

London, *January 20th*, 1928. **Electrical Utilities, Ltd.**

Shoddy Wiring.

Once again, through the pages of our technical journal come further remarks from the pen of Mr. H. R. Taunton *re* "Mr. Shoddy" and his accomplices. The writer has often expressed himself through the "Correspondence" columns of the REVIEW, and his opinion on this vexed question has not changed. Mr. Taunton points out a way for the eradication of incompetents, and if it were possible to get a few "Tauntons" gathered together, it might be possible to *really* do something to exterminate for ever the pests that invade the electrical contracting industry. As shoddy electrical installations (of late years) seem to have had the backing of influential circles, it will not be an easy matter to remove the cause of the shoddiness. Nevertheless, hard as this may seem, I, like Mr. Taunton, do not think this task an impossible one. Supply authorities are the people to whom we ought to look for guidance, but it seems that we would get equal satisfaction by looking for help from any gas undertaking. In my opinion the E.C.A. has proved a miserable failure so far as "doing anything" is concerned, and with the present constitution of this Association I would say it is impossible for anything to be done. I might say here that I have refrained from becoming a member of the E.C.A. because the opinions held by me would be objectionable to a large number of members of the Association. I would suggest, however, that they "rub it out" and do it all over again, then possibly I may consider sending in an application form. I have been connected with the electrical business for 25 years, without a break, and do not know of any other business where so much shoddiness is tolerated nor where wangling of trade discounts is carried on to such an extent. Unfortunately, I do not possess sufficient organising ability to bring into being an association which would be out to "do" something in the way of soliciting Government interference. I am, however, ready to give a hand in the fighting line of any such organisation. In the meantime I look forward, with pleasure, to the continuation of Mr. Taunton's article, and as a reader of the REVIEW I thank him.

Alex. Milne.

Glasgow, *January 21st*, 1928.

[Several letters have been received too late for inclusion in this issue.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1926.

15,392. "Method and apparatus for starting electromotors by means of an automatic starting coupling." Albo Kupplung Ges., and K. Obermoser. June 18th, 1925. (253,333.)

18,931. "Prepayment meters." Allgemeine Elektricitats Ges. July 29th, 1925. (256,249.)

23,431. "Means for indicating current impulses." Mix & Genest Akt. Ges. and O. Lohaus September 22nd, 1926. (282,854.)

23,592. "Electrical remote control systems." General Electric Co., Ltd., and N. C. Smart. September 24th, 1926. (282,858.)

23,968. "Dynamo-electric machines." F. W. Lanchester and Lanchester's Laboratories, Ltd. September 28th, 1926. (282,880.)

24,027. "Electrical switches and switch fuses." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. September 29th, 1926. (282,884.)

24,138. "Combined starting, controlling, stopping, and braking gear for electrically-driven machines." Brookhirst Switchgear, Ltd., and A. C. Livesey. September 30th, 1926. (282,888.)

24,300. "Mounting of electric fuses." English Electric Co., Ltd., and A. M. Pooley. October 1st, 1926. (282,898.)

24,424. "Electrical energy transferring, transforming, coupling, and the like devices." C. S. Franklin and E. Green. October 2nd, 1926. (282,905.)

24,425. "Means for recording or reproducing sound." A. A. Linsell. October 2nd, 1926. (282,906.)

24,656. "Brush holders for dynamo-electric machines." English Electric Co., Ltd., and E. H. H. Hassler. October 5th, 1926. (282,909.)

24,671. "Control of lifts operated by polyphase electromotors." Smith, Major & Stevens, Ltd., and P. H. Stevens. October 5th, 1926 (282,910.)

25,859. "Timing devices for magneto-electric machines." British Thomson-Houston Co., Ltd., L. Griffiths, and A. G. Henton. October 16th, 1926. (282,922.)

26,077. "Thermionic electron tubes." Vereinigte Gluhlampen und Electricitats Akt. Ges. July 8th, 1926. (274,019.)

26,198. "Method of and apparatus for radiating sound waves." L. Mellersh-Jackson (Acme Apparatus Co.). October 20th, 1926. (282,931.)

26,606. "Arrangements of spark gaps and sparking plugs." W. Dubilier. October 25th, 1926. (282,936.)

29,107. "Method for producing highly-emitting oxide cathodes for electron tubes." E. Schrack and R. Ettenreich (trading as Radiowerk E. Schrack). August 6th, 1926. (275,542.)

29,501. "Electrical locking and releasing switch." J. Stephenson. November 22nd, 1926. (282,952.)

29,637. "Self starters for motor-vehicle engines." C. H. Greenwood. November 23rd, 1926. (282,954.)

29,804. "High-tension battery eliminator devices for use in wireless telephony." E. C. Rooker. November 24th, 1926. (282,956.)

29,827. "Lightning arresters." Ericsson Telephones, Ltd., F. McClarence and A. Brookes. November 25th, 1926. (282,957.)

30,106. "Wall-boxes for switches and the like." G. A. Leitch November 29th, 1926. (282,959.)

30,447. "Electric welding machines." W. J. Gladitz. December 1st, 1926. (282,960.)

30,615. "Magnetically-actuated friction clutches." M. Walker. December 3rd, 1926. (282,962.)

32,384. "Electric switches." M. J. Railing and F. G. Quance. December 22nd, 1926. (282,975.)

1927.

1,484. "Starting of electric motor convertors." English Electric Co., Ltd., and R. L. Cleaver. January 18th, 1927. (282,995.)

3,344. "Electric sound-emitting devices or loud speakers." International General Electric Co., Inc. February 13th, 1926. (Addition to 264,811.) (265,958.)

6,838. "Electric spot welding machines." International General Electric Co., Inc. March 13th, 1926. (267,544.)

10,619. "Traffic signals." L. Mellersh Jackson (Crouse-Hinds Co.). April 20th, 1927. (283,021.)

10,853. "Sparking plugs for internal-combustion engines." M. Eyquem. February 8th, 1927. (283,034.)

11,676. "Multiple thermionic valves." Dr. S. Loewe. April 30th, 1926. (270,345.)

12,077. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. September 7th, 1926. (277,292.)

15,523. "Electric ignition systems." British Thomson-Houston Co., Ltd. June 14th, 1926. (272,537.)

15,638. "Electric high-tension insulators." E. C. R. Marks (Akt Ges. Brown, Boveri et Cie.). June 11th, 1927. (283,065.)

17,619. "Manufacture of electrical resistances." Carborundum Co., Ltd April 5th, 1927. (283,076.)

17,839. "Radio transmission systems." C. Lorenz Akt. Ges. July 5th, 1926. (273,772.)

19,672. "Spring plug contacts for electrical purposes." R. Hoffmann. July 27th, 1926. (275,226.)

22,088. "Electrically controlled valve-actuating mechanism." Westinghouse Electric & Manufacturing Co. January 29th, 1927. (282,610.)

26,109. "Device for supporting and carrying all the instruments and switch arrangements of a motor-car." A. Schindling. October 3rd, 1927. (282,616.)

26,923. "Automatically-operated liquid slip-regulators for induction motors." International General Electric Co., Inc. October 15th, 1926. (279,079.)

27,057. "Systems of electric motor control." British Thomson-Houston Co., Ltd. October 19th, 1926. (279,433.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 18th:—

Hytor. No. 485,395. Class 6. Turbines, vacuum pumps, air compressors, &c.—Nash Engineering Co., South Norwalk, Conn., U.S.A. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Serenada. No. 484,600. All goods in Class 8.—V. Zeitlin & Co., 144, Theobalds Road, W.C.1.

Duralex. No. 484,279. Class 13. Junction boxes, and fittings for electric lighting and heating, signalling and power installations.—H. F. McLoughlin, "Kenwood," Streetbrook Road, Solihull, Birmingham.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERYSTWYTH.—Housing scheme (30); borough surveyor.

ARMTHORPE.—School extensions (£16,750); West Riding Education Committee.

BEACONSFIELD (BUCKS).—Workshops, film studios, for the Lion Cinema Co.

BIRKENHEAD.—Additional 200 houses, Higher Bebington, for the T.C.; borough surveyor.

BIRMINGHAM.—Library, Ward End; librarian. Refuse disposal plant (£22,000); city engineer.

BOURNEMOUTH.—Cinema and business premises, Christchurch Road; T. J. Rowley. Garage and showrooms, Charminster Road; Sinclair Bros. Garage and petrol depôt, Shelton Road; Shell-Mex, Ltd. Business premises and flats, Bourne Avenue; Messrs. Hankinsons. Welfare centres, Stourfield and Winton; Medical Officer of Health.

BRISTOL.—Greyhound racing track, Filton, for the International Dog Racing Association, Ltd., London.

CAERPHILLY.—Additional 104 houses, for the U.D.C.; surveyor.

CHERTSEY.—Houses (50), for the U.D.C.; E. Clark & Sons, builders, Melton Mowbray.

DALTON.—Mining centre; West Riding Education Committee.

DARFIELD.—Electric lighting, elementary school; West Riding Education Committee.

DERBY.—Additional office block for the Derbyshire C.C.; county architect.

DRIGHLINGTON.—Electric lighting, Council school; West Riding Education Committee.

DUNDEE.—Dispensary at Royal Infirmary (£21,000); the medical superintendent.

ELDWICK.—Ultra violet ray equipment, Sanatorium; West Riding County Medical Officer.

FLINT.—Housing scheme (38), for the T.C.; W. B. Edwards, architect, 84, Church Street.

GLASGOW.—Houses (700) for the Corporation at Pollokshaws; 36 tenement houses, Westmuir Street; housing director. 124 steel houses, Knightswood; Atholl Co. Cinema, Knightscliffe Avenue, Knightswood; W. Inglis, architect, 216, Bath Street.

GRAVESEND.—Conversion Parrock Hall, Milton Avenue, to flats; Robert Hopkins & Sons.

HAMILTON.—Extensions, maternity home and child welfare centre (£4,600), for the T.C.; burgh surveyor.

HARROGATE.—Secondary school (£65,000); West Riding Education Committee.

HASTINGS.—Shop, Wellington Place; F. W. Woolworth and Co. Buildings, White Rock approach (£19,000); Eldridge and Cruttenden.

HEMSWORTH.—Extensions, secondary school; West Riding Education Committee. Senior mining centre; West Riding Education Committee and Miners' Welfare Fund.

HENDON.—Goldbeaters' School (£44,000), for the E.C.; Welwyn Builders, Ltd., contractors, Welwyn Garden City.

HORSHAM.—Housing scheme (96), Millthorpe Estate, Littlehaven Lane, Roffey; C. G. Atkinson, surveyor, Town Hall Chambers.

HOVE.—Houses (100), Knoll Estate; borough engineer.

IRISH FREE STATE (LIMERICK).—Extension of County Hospital for the County Board of Health.

(MILLTOWN, CO. DUBLIN).—Houses (58), for Irish Sailors' and Soldiers' Land Trust; R. E. Beckerson, chief clerk, 30, Lower Fitzwilliam Street, Dublin.

KILMARNOCK.—Housing scheme (40), for the T.C.; burgh surveyor.

LEAMINGTON.—Extensions, library, museum, and art gallery (£3,250), for the T.C.; borough surveyor. 50 houses, Rushmore Farm; borough engineer.

LONDON (ST. MARYLEBONE, N.W.).—Additions 82, Princess Street, Gunton & Gunton.

(BERMONDSEY, S.E.).—Alterations, Southern Railway offices, Joiner Street; E. J. Logan. Offices, Queen Elizabeth Street, for Courage & Co., Ltd.; F. M. Kirby.

(CATFORD, S.E.).—Store and flats, Bromley Road; Bethell, Swanell & Co.

(FOREST HILL, S.E.).—Additions, Stanstead Picture Theatre, Wastdale Road; F. Matcham & Co.

(LEWISHAM, S.E.).—Warehouse, High Street; Carrington, Thomas & Co., Ltd. 26 houses, Boveney Road; Wm. Wilmot, Ltd.

LONDON—*Contd.*

(WESTMINSTER, S.W.).—North block, Grosvenor House site; Wimperis, Simpson & Guthrie. Fittings and electric lighting, St. Martin's Street Library; librarian.

LOWESTOFT.—Showrooms and garages, Belvedere Road; D. Leighton & Sons.

MACCLESFIELD.—Additions to farm buildings, Parkside Mental Hospital; F. A. Browne, county architect, Newgate Street, Chester.

MANCHESTER.—Palais de Danse, Whitworth Street; city surveyor.

MARGATE.—Alterations and additions, Grand Hotel; Reeve and Reeve, architects.

MERTON.—School, West Barnes, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

MOLD.—Weight and measures department, and conversion of premises into library, for Flints C.C.; R. G. Whitley, county architect.

NORTHAMPTON.—Additional 46 houses for the T.C.; Alfred Fidler, borough engineer.

NORTHERN IRELAND (OMAGH, CO. TYRONE).—Technical school, for the Technical Instruction Committee.

NORTHFLEET.—Extensions, Co-operative premises, The Hill; Gravesend Co-operative Society.

OLD FLETTON.—School, Woodston, for Hunts E.C.; S. G. Cook, secretary, Huntingdon.

ORSETT.—Housing scheme (30), Little Thurrock, for the R.D.C.; G. F. Andrassy, surveyor, Palmer's Avenue, Grays.

PONTEFRACT.—New buildings, King's School (£31,000); governors.

PRESTWICH.—Extensions, Myrtle Grove Works; J. & H. Bleakley, Ltd.

RADCLIFFE.—Additional 50 houses for the U.D.C.; surveyor.

REDCAR.—Concert hall (£3,000), for the T.C.; surveyor.

ROSSINGTON.—Cinema; J. Farnworth, architect, 17, St. Margaret's Drive, Chesterfield; J. Williams, Morton, Derbyshire.

ROTHERHAM.—Technical school, Howard Street; A. F. Scott and Son, architects, Norwich. By-product house and plant, market; borough engineer.

ROTHWELL.—Electric lighting, Robin Head School; West Riding Education Committee.

RUSHDEN.—Extensions, boot factory, for John White.

SEAHAM HARBOUR.—Alterations to municipal offices; U.D.C. surveyor.

SELBY.—Extensions, Art and Technical School; West Riding Education Committee.

SHOTTON (CHESTER).—Extensions, Grosvenor Working Men's Social Club; H. Parry Jones, architect, 23, Chester Road, Queensferry.

SOUTHEND-ON-SEA.—Additional 107 houses and block of 12 flats, for the T.C.; R. H. Dyer, borough engineer. School (£9,400), for the borough E.C.; G. Henson and Son, Ltd., builders, Wellingborough.

SOUTH KIRBY.—Mining centre; West Riding Education Committee.

SOUTH KIRBY.—School (£7,000); West Riding Education Committee.

STIRLING.—Miners' Welfare Institute (£9,000); J. Bruce, architect.

STORRINGTON.—Electric lighting, Parish Church; rector.

STRETFORD.—52 houses, King's Road; J. G. Whitelegg. Extensions, Westinghouse Road; Rubber Regenerating Co., Ltd. Extensions, Textilose Road; Courtaulds, Ltd.

SWANSEA.—Greyhound race track, Manselton; Welsh Racing and Athletic Association, Ltd.

TORQUAY.—Laundry, for Torbay Hospital general committee; secretary.

TRURO.—Re-construction of bank, Barclay's Bank, Ltd.; F. C. West, builder, Newquay.

TYNEMOUTH.—Shops and flats, St. George's Crescent and Churton Green; F. R. N. Haswell & Son.

WATFORD.—School (£14,065) and extensions, Boys' Grammar School (£4,417), for Herts E.C.; county surveyor, Hatfield.

WEM (SALOP).—Cheese Hall, for the U.D.C.; surveyor.

WEYMOUTH.—Reclamation of backwater (£8,000); H. J. Deane, consulting engineer. Office accommodation; Education Committee.

WHITCHURCH (SALOP).—Premises, High Street, for the National Provincial Bank, Ltd.

WORCESTER.—Housing schemes (22); W. Ransome, city engineer, Guildhall.

WREXHAM.—Extensions, Denbighshire technical institute (£20,000), for the governors; secretary.